THE

PLANNING AND CONSTRUCTION

OF

AMERICAN THEATRES.

BY

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Fully Illustrated.

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PREFACE.

THEATRES, opera houses, and public halls among the cities of this country have become so numerous, the planning and construction so governed by stringent building laws enacted and revised from time to time for the safety of the public, that the author has been induced to prepare this volume for architects and others interested in this class of structures.

In the preparation of the work the writer is under obligations and here makes his acknowledgments to well-known architects who have made the subject a special study, and from their latest examples of modern theatres the illustrations have been taken.

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THE PLANNING AND CONSTRUCTION OF AMERICAN THEATRES.

INTRODUCTION.

WE are informed that dramatic history in New York began more than a century and a half ago. The first dramatic performance ever seen in America was given in this city during the last week in September, 1732. The first playhouse was the Nassau Street Theatre, on the east side of Nassau Street—then called Kip—between John Street and Maiden Lane. It was a wooden structure, and opened March 5, 1750. Kean and Murray were the managers, and the play for the first night was *Richard III.* There were performances twice a week, and the season lasted for five months. This house gave way to a new one, built in 1753 by Lewis and William Hallen, the one a manager, the other an actor; but in a few years the new house was converted into a church for the use of the German Calvinists.

David Douglass built in 1761 a theatre at Nassau and Beekman streets, where Temple Court now stands, at which, on November 26th of the same year, *Hamlet* was presented for the first time in America. The cost of this playhouse was $1625. The dimensions were 40 by 90 feet.

From 1761 to the present time what a contrast and advancement are perceptible!

The Madison Square Garden and the Metropolitan Opera

House, built within the last six years, are of special prominence because of their magnitude as buildings and of the expenditure of enormous sums of money.

The Madison Square Garden in magnitude is the more important of the two. It is the largest building in America devoted entirely to amusements, and cost about $3,000,000. It occupies the entire block bounded by Madison and Fourth avenues, Twenty-sixth and Twenty-seventh streets. It is 465 feet long and 200 feet wide, and its walls rise to a height of 65 feet. Architecturally it is a magnificent structure, because of the simplicity of the construction and the absence of trifling details in the ornamentation. The style is in the Renaissance, and the materials buff brick and terra cotta. The roof is flat, or nearly so, but the sky-lines are broken by a colonnade which rises above the roof at the Madison Avenue end and extends along either side for 100 feet; by six open cupolas, with semi-spherical domes, which rise above the colonnade; by two towers at the Fourth Avenue corners; and by a magnificent square tower which rises from the Twenty-sixth Street side, with its lines unbroken for 249 feet, and then in a series of open cupolas, decreasing in diameter, on the smallest and topmost of which is posed a figure of Diana, of heroic size, the crown of whose head is 332 feet from the sidewalk.

At the Madison Avenue end, and extending on either side for a distance of 150 feet, there is an open arcade which covers the sidewalk, and the roof of which rests upon pillars of polished granite and brick piers. The top of the arcade is laid out as a promenade. The main entrance to the building is at the Madison Avenue end, through a triple doorway, and above it is the most prominent feature of exterior decoration, an elaborate arch in terra cotta set in relief into the wall.

From the entrance a lobby 100 feet long and 23 feet wide

METROPOLITAN OPERA HOUSE, N. Y.

CADY, BERG & SEE,
ARCHITECTS.

Interior Remodelled by
J. B. MCELFATRICK & SON, ARCHITECTS.

leads to a foyer, and this opens into the amphitheatre, which is the main feature of the building. This hall is 300 feet long, 200 feet wide, and 59 feet to the bottom of the girders. In the centre is the arena floor, 268 feet long and 122 feet wide, with parallel straight sides and semi-circular ends, and from this floor rise the box tiers and rows upon rows of seats, extending back to the walls. No attempt has been made at decoration, other than to leave all the construction open to view, and to paint the columns, roof-girders, etc., a light buff tint; and the beauty of the interior resides in the simplicity and in the light and graceful appearance of the construction.

Properly speaking there is no stage, but when one is required it is constructed at the east end. There are 110 arena boxes around the edges of the floor, 52 in the first tier, 26 in the second, and 26 in the third. With the floor left open for a performance like that of a circus, for example, there are seats for 5000 people. With the floor occupied by chairs, as for concerts, leaving space either in the centre or at the eastern end for a band-stand, the seating capacity is 9000, and there is standing room for many thousands more. On the opening night, June 16, 1890, with a concert by Edward Strauss's orchestra, there were present 17,000 people; and that ample provisions for exit had been made was shown in the fact that the amphitheatre was vacated after the performance in 4½ minutes.

There are ten exits, and all of them save on Fourth Avenue are on inclines without stairs.

In the Madison Avenue and Twenty-sixth Street corner of the building there is on the first floor a café 115 feet long and 70 feet wide. Above it is a concert-hall, elaborated in white and gold, with two balconies, the lower of which is divided into 36 open boxes. The seating capacity is 1100. Opening from the lower balcony there is an assembly or

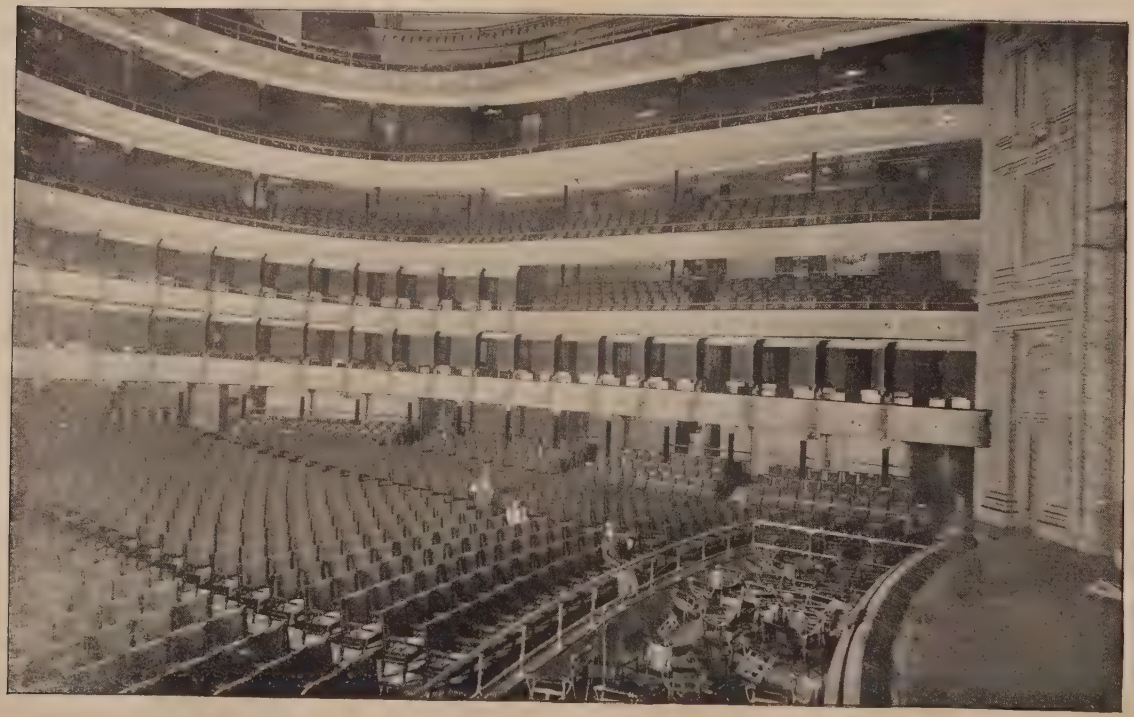
dining hall, 69 by 32 feet; and connected therewith is a kitchen equipment.

Above the Madison Avenue end of the building there is a roof-garden 200 by 80 feet, with a small stage or band-stand. This was opened for the first time on May 30, 1892, and it is estimated that 3500 people were present.

At the Madison Avenue and Twenty-seventh Street corner, occupying a space 115 feet long and 70 feet wide, is the Garden Theatre. The auditorium, with eight boxes, a balcony, and a gallery, has a seating capacity of about 1200. The Garden Theatre was opened September 27, 1890.

The Metropolitan Opera House, which occupies the whole block bounded by Broadway, Seventh Avenue, Thirty-ninth and Fortieth streets, is perhaps the second establishment of importance in the country. It was built by a corporation and cost about $1,500,000. The building is of buff brick, stone, and iron, in the Italian Renaissance style of architecture. The exterior dimensions are: on Broadway, 205 feet; Thirty-ninth Street, 284 feet; Seventh Avenue, 197 feet; Fortieth Street, 229 feet. The main auditorium is reached from the front through a vestibule 65 by 35 feet, and from either side through vestibules which are 33 feet wide and 70 and 50 feet in length, respectively. All three vestibules open into a semi-circular corridor which extends around the auditorium to the proscenium wall on either side.

The Opera House was opened October 22, 1883, and the interior was destroyed by fire August 27, 1892. On Tuesday, November 28, 1893, the building was again opened, with the interior entirely remodelled. The first circle of boxes originally placed on each side of the house is removed, and the floor lowered three and one half feet to allow three rows of chairs, forming the orchestra circle, to be placed around the entire auditorium under the *parterre* tier of boxes. The entire seating capacity is 3,200.



REMODELLED INTERIOR OF METROPOLITAN OPERA HOUSE, BROADWAY, BETWEEN THIRTY-EIGHTH AND THIRTY NINTH STREETS, N. Y.

J. B. McElfatrick & Son, Architects.

In the *parterre* tier there are thirty-five boxes; in the next or *grand* tier there are nineteen boxes in the centre, similar in size and shape to those of the *parterre*, while on the north side of the former there are twenty small open boxes in two rows, each capable of seating four persons, and on the south side, filling the corresponding space, is one *omnibus* box holding 106 seats. This box is shut off from the balance of the house and is entered directly from the club-room. Above the two box-tiers come the dress-circle, the balcony, and the family circle, in the order named, all connected, in addition to stairs, by four large elevators at the Fortieth Street entrance, each capable of carrying 35 or 40 persons and running to the top of the building.

The foundation colors of the decoration throughout the house are ivory-white, gold, and deep red, or rather maroon. The chairs are covered with maroon-colored tapestry of a corded silk material. Upon the back of each chair there is an ornamental design worked in dead-gold-colored silk thread. The chairs in the balcony are upholstered in leather of the same color, while those in the family circle have perforated wooden seats and backs.

The hangings between the *parterre* boxes and the nineteen in the *grand* tier are of a maroon tint. The walls of the boxes are covered with a corded silk tapestry of the same hue, having a tiny *fleur-de-lis* worked on it in glossy red silk thread, which causes it to stand out with very happy results.

The walls of the anterooms are covered with similar material, but of a dead-gold color. The stage, which has been lowered several feet from the original, is fitted up with all the latest appliances. The proscenium opening is 54 by 50 feet. The width of stage from wall to wall is 100 feet, and the depth from the back wall to the curtain-line is 73 feet; to the footlights, 86 feet.

The height of the *gridiron* or rigging-loft is 88 feet.

The lighting of the house leaves nothing to be desired. There are 10,000 electric lamps, nearly half of which are on the stage. Incandescent lamps in ground-glass globes shed a soft light over the auditorium from the ceiling, from the tops of the pillars, and from rows which extend along the frieze of the cornices.

On the orchestra floor an excellently appointed dressing-parlor for ladies has been fitted up. In addition to the above, dressing-rooms have been placed on each floor for ladies and gentlemen. There are seventy-eight exits in all from the house, and every precaution has been taken against disaster by fire.

The wish of Chicago to possess an opera house larger and finer than the Metropolitan of New York, a hall for great choral and orchestral concerts, a mammoth ball-room, a convention hall, an auditorium for mass meetings, all under the same roof and within the same walls, gave birth to the Auditorium.

In addition to the opera house the building contains offices, stores, and a hotel. The most daring and conspicuously successful structural feature of the hotel is a truss construction, 118 feet span, carrying the banquet-hall, weighing 660 tons, over the auditorium; and those over the stage, with a span of 110 feet, carrying a load of 2500 tons composed of stage machinery, rigging-loft, fly-galleries, four stories of hotel-rooms and working departments, all of fire-proof construction. The auditorium proper with its accessories occupies an area of 35,800 square feet. Its general dimensions are 118 by 246 feet. To the above must be added the spaces occupied for entrances and exits, for parlors, smoking-rooms, organ-chamber, and stage dressing-rooms.

Upon the main floor the stage occupies a depth of 70 feet, the *orchestra* 12 feet, the *parquette* 104 feet, and the main *foyer*

INTERIOR VIEW OF THE AUDITORIUM, CHICAGO, ILL.

60 feet. The main floor contains about 1400 seats arranged in sweeping curves, stepped up with a rise of 17 feet.

Advantage is taken of this rise to obtain under the higher parts of the *parquette* an entrance foyer, 80 by 118 feet, and a series of wardrobes and cloak-rooms of quite generous capacity.

On the outside of the above are corridors 14 feet wide. This unusually great rise of the main floor has also made practicable the arrangement of six entrances, by which the lower half of the parquette seats are reached without rendering it necessary to climb to the upper level of the main floor.

The main balcony, elliptical in plan, is 80 feet deep at the end, but quite narrow at the sides. It covers the main foyer, and overhangs the parquette 20 feet at the end, but is not wide enough at the sides to completely cover the boxes.

The seats are arranged into a rise of 40 feet from the lowest to the highest.

Advantage has again been taken of the rise to form two foyers, of which the lower is 40 and the upper 20 feet wide. This balcony contains about 1600 seats. The two galleries above the balcony contain each 500 seats.

It will be seen from the foregoing that the Auditorium contains, including the boxes, 4200 seats.

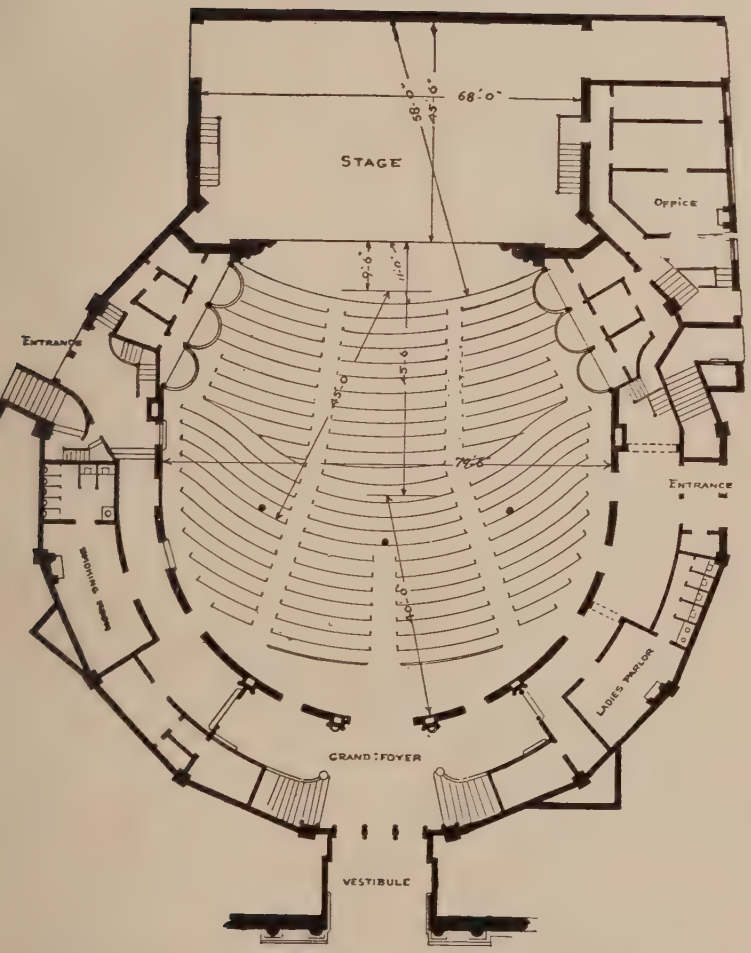
The dimensions of the stage are 70 by 110 feet. The height from the floor to the rigging-loft is 95 feet. The stage floor is divided into sections, all of which are separately or jointly movable in a vertical plane. This movement is effected by 20 hydraulic jacks, the plungers of which range from 6 to 24 inches in diameter, and are operated under a pressure of 100 pounds per square inch. The valves controlling these jacks are concentrated in such a manner that a person operating them is always in communication with and under control of the stage manager. It is possible with this apparatus to rieate variations and gradations of level of stage floor almost

instantaneously in any direction, up, down, or oblique, for any part of the stage floor. This hydraulic apparatus is modelled upon that patented by the "Asphalia" of Vienna, and applied in the opera houses of Buda-Pesth, Prague, and Halle.

The ingenuity of American builders of hydraulic elevators and the special conditions prevailing in this building have, however, caused the introduction of many improvements and modifications of the European apparatus.

The success of the main room of the Chicago Auditorium is greatest when used as a hall for mass concerts and as an opera house. It is not so well adapted for dramatic performances, on account of the great distance from stage to the farthest seats.

It is the intention of the writer to confine the illustrations to the planning and construction of much smaller buildings than those just mentioned, describing the latest examples at which regular dramatic performances are given, with the accessories of stage, scenery, and curtains, combining all the requirements for the ideal theatre building of the last decade of the nineteenth century.



PARQUETTE OF CASTLE SQUARE THEATRE, BOSTON, MASS.

H. W Maynard, Architect.

THE CASTLE SQUARE THEATRE.

Thespis has not a more beautiful temple in this country than Boston's new and most magnificent home of the drama, the Castle Square Theatre, one of the finest, safest, best equipped, most comfortable and most elaborately furnished buildings devoted to theatrical purposes. The entire press of New England, as well as the representative journals in the States, have united in the fullest measure of praise of its grandeur.

The situation of the theatre, as every Bostonian is aware, is on the spacious square formed by the junction of Tremont, Chandler, and Ferdinand streets. As far as the public convenience is concerned the site is a happy selection. The Providence depot, and the Columbus Avenue station of the Boston and Albany Railroad, are not five minutes' walk distant; the prominent street-car lines of the city and the West End, the South Boston, and Cambridge lines are but a few steps removed; the elevated railway has a station at Castle Square; and altogether the location is as easy of access as that of any other theatre in the city.

What but a few months before the opening night, November 19, 1894, was an unsightly building has been transformed into a gorgeously appointed theatre.

Before passing through the principal entrance on Tremont Street, we are confronted by an arcade with a height of thirty feet from the ground, classic in style, and built of brick and terra cotta.

Two engaged columns of the Corinthian order stand on either side, on pedestals eleven feet high, and support an elaborately moulded terra-cotta frieze and cornice. Great garlands in terra-cotta relief interwine theatrical insignia, and

on each side of the arch a group of six immense wrought-iron lanterns of colonial style cast a brilliant light over the whole scheme of decoration. From the roof of the arch rows of electric globes send their brilliancy down and emphasize the artistic finish of the large 16′ × 16′ vestibule. On the right and left of the sides of the vestibule are great terra-cotta panels each bearing the figure of a Greek dancing girl. In front and above are immense stained-glass windows, bearing in many-colored glass the outlines of a mediæval castle and the name of the theatre.

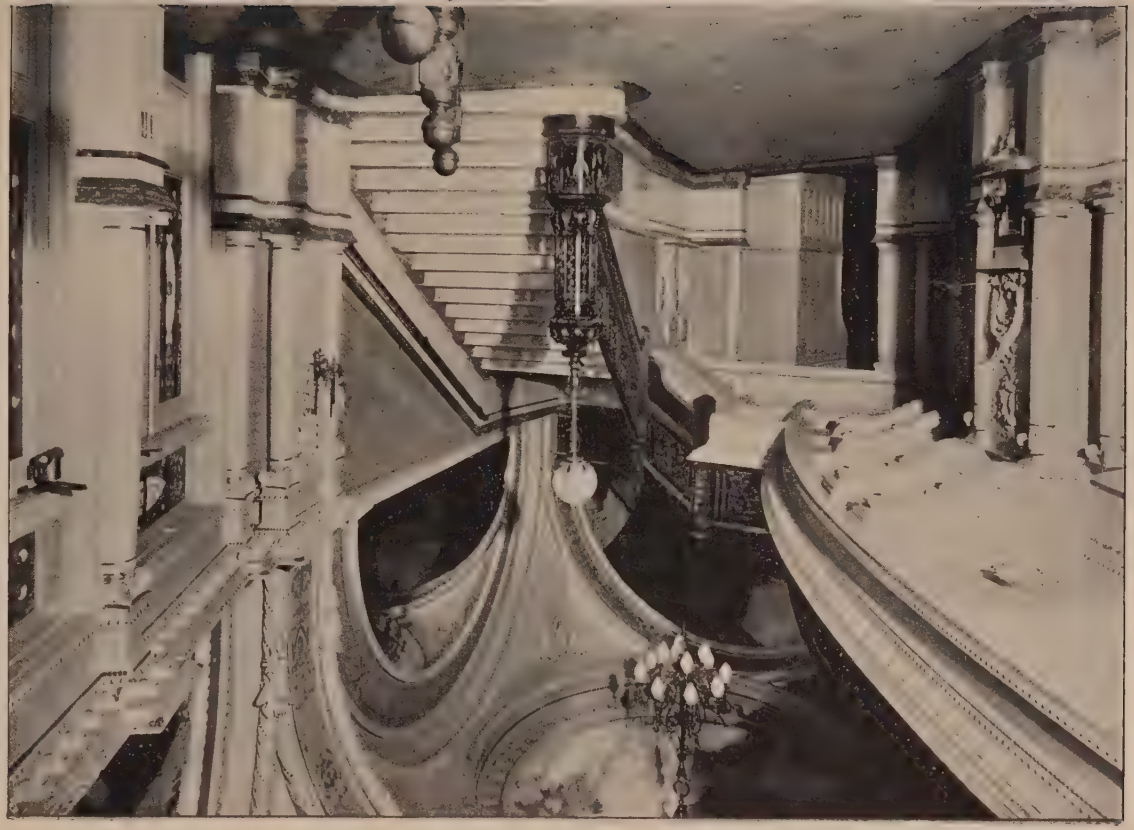
Passing through the main doors from the vestibule we enter the "grand foyer." Turning to the right or left we reach the mezzanine balcony by the grand staircases with their handsome electro-bronze newels and balusters, the top of the newels being set off by large electric-light globes.

The grand foyer, or lobby as it is sometimes called, is circular in form, 19 feet wide, including staircases, and 60 feet in length. The staircases are each 8 feet wide, built of iron and marble.

By glancing at the ceiling of the foyer we are shown the Guastavian domes blazing with light, which shed their brilliance over the most beautiful paintings that have ever decorated the ceilings of a theatre.

Scarcely are the beauties of the domes considered when we discover succession after succession of similar domes, with myriad circles of cherubs reaching away into a seemingly endless distance. The effect is so real and so astonishing, the purity and transparency of the glass so wonderful, that we had not noticed great mirrors set over the entrance-doors at such angles as to reflect in their clear depths almost every part of the entire theatre.

From the foyer on the right is situated the ladies' parlor, 12 feet wide by 20 feet long, a dainty resting-place furnished as in the days of Louis XVI. Its pretty onyx marble fire-



place, combined with the silken finish of the walls, its soft carpet in delicate design and colors, and the gilded furniture, lend to it an indescribable charm which is heightened by large mirrors covering two of its walls.

In sharp contrast to the ladies' parlor is the masculine appearance of the gentlemen's smoking-room—12 feet wide by 27 feet long—situated upon the opposite side of the building, but the same lavish generosity has made it an ideal place to court. Its leather-covered furnishings are solidly magnificent, commodious, restful, and inviting.

The beauty of the foyer is difficult to surpass. Exits from the auditorium, hung with draperies in softest red, are numerous. Cloak-rooms, dressing-rooms, and toilet-rooms are situated with a generous regard to comfort and convenience. The floors are of neat designs in mosaic tilings. Great arches, panelled, and beautified with exquisite paintings, are seen on every side. Directly opposite the vestibule doors are dainty Sienna marble fountains, with gold faucets. The walls are finished in satin effect, and the harmony of coloring in this part of the theatre defies description.

As we enter the auditorium through the doors shown upon the view from the stage, we see a series of domes supported upon the steel construction of the balcony, and a scheme of decoration after the Italian Renaissance style, the relief work being in cream and gold. Directly over the auditorium an immense circular electrolier, 40 feet in diameter, spreads its twenty arms out from the centre of the dome, and its three hundred and eighty incandescent lamps of frosted glass send their rays to every part of the auditorium with a grand illuminating effect.

Encircling this electrolier is another division of the dome, suspended from the electrolier a short distance, resplendent with floating cherubim trailing a bewildering mass of ribbons and garlands of flowers in their merry race around the

wide-spreading branch of three hundred and eighty electric lights. No less attractive are the proscenium arch, and the boxes, twenty in number, furnished with superb designs in stereo-relief. Beautiful beyond all is the sounding-board, a portion of which is shown in plate view of boxes, with a depth of fifteen feet over the proscenium arch, bearing the most exquisite work in painting about the theatre. Twelve dancing girls, life size in figure, present themselves in artistic abandon. The work was so elaborate that it was first executed on canvas in New York and then brought to the theatre to grace the sounding-board. The magnificence of the auditorium is entrancing. Wherever art has laid her finger she has left an impress of beauty. The grand sweep of the balconies, the soft harmony of the colorings, the beauty of the relief decorations, and the masterfulness of the paintings have impressed us with the fact that we have found an æsthetically perfect theatre.

While art has left its impressions, mechanical science appeals to us for a hearing. Every hygienic law has been considered in the construction. Pure air is forced into the building by a system of ventilation perfect in its conception. Each floor has a hollow space to admit the air from the immense air-ducts, supplied by a mammoth blower. The air is carried to every seat and forced into the house through the hollow-legged chairs.

We are attracted by the general roominess about the auditorium, and at once discover another distinctive feature in the seating arrangements. Every chair is of more than ordinary width, the places between them being so generous as to admit of free passage even when the audience is seated; even to the back seat of the second balcony, the chosen throne of the "gallery god." This majestic critic, the terror of all "thespians," is seated in comfort. He sits in a chair covered with finest plush.

MEZZANINE BALCONY, CASTLE SQUARE THEATRE.

CEILING OF FOYER, CASTLE SQUARE THEATRE.

VIEW FROM STAGE, CASTLE SQUARE THEATRE.

If we now turn to a view of the stage, we find that the proscenium arch is 40 feet wide and 34 feet high to the overhead girders, and its soft velvet curtain hides an ideal stage, 68 feet wide and 45 feet in depth.

Almost every appliance known to the theatrical world has entered into the construction of this theatre. Its electrical equipment of one thousand 32-candle-power lamps is as nearly perfect as modern science can make it.

Broad entrances on each side lead to the streets adjoining, and a cavalcade of horses can enter at one side, make a circuit of the stage and return.

The switchboard which controls the light effects is a marvellous piece of mechanism. It is similar to that used at the Metropolitan Opera House, N. Y.

The theatre is fully equipped with the most approved fire-aparatus. Instead of single standpipes, a complete duplicate set is used. Adequate standpipes on each side of the stage are augmented by axes, hooks, brackets, and fire-extinguishers on each fly-gallery, paint-bridge, gridiron, and roof. In the construction only iron, marble, and brick have been used. There are no wooden beams, bracings, or floors; in fact, no wood-work of any kind, even composition mouldings taking the place of wood in the door-trimmings.

The seating capacity is from 1600 to 1800.

The general outlay of the Castle Square Theatre is shown by the plan, which fully describes the main floor or parquette, and parquette circle, with all the necessary entrances and stairways leading to the various portions of the house.

The main entrance to the grand foyer is from Castle Square, the entrance to the right from Chandler Street, and that from the left an alley leading to Tremont Street. The main entrance, from Castle Square, is 16 feet wide, the Chandler Street entrance 10 feet wide, and that from Tremont Street also 10 feet.

The balcony is reached from the grand foyer; the gallery from stairways to the right and left adjoining the Chandler Street and alley entrances. These latter stairways are each 6 feet wide and built of iron and slate.

From the foyer and lobbies the auditorium is reached by ten wide doorways. The auditorium is 79 feet 6 inches wide, 85 feet 6 inches deep, and 70 feet in height to the top of the dome ceiling. All calculations are taken from the curtain line. The outer line of the footlights from the curtain-line is 6 feet, the orchestra rail 11 feet, and the latter is drawn from a point upon the centre-line of the opening extending backward 58 feet, and from the same point the seat-rows of the parquette, 2 feet 8 inches apart, are drawn.

The parquette circle is arranged in steps which are described from a point upon the centre-line extending into the auditorium 9 feet 6 inches. (See the plan, upon which these figures are clearly shown.)

The first stepping of the circle is 2 inches, and each successive step is increased by ½ inch for 13 steps.

The various aisles of this main floor are divided as shown, 3 feet wide at the orchestra-rail and 5 feet nearest the outer circle.

The boxes, six in number, are reached through small reception-rooms connected by a passage leading to the lobby on the right and the left of the entrance from Tremont Street.

There are also upon this floor, connected to the lobbies, check-rooms, writing-room, telephone-room, and toilets attached to the ladies' parlor and the smoking-room.

The check-room to the right under the balcony staircase is 7 feet 6 inches wide by 14 feet long, and the left check-room, under the corresponding staircase, is the same size. Adjoining this left check-room are the telephone and writing rooms, 7 feet 6 inches wide by 16 feet long. The toilet

VIEW OF STAGE, CASTLE SQUARE THEATRE.

PROSCENIUM ARCH AND BOXES. CASTLE SQUARE THEATRE.

adjoining the ladies' parlor is 7 feet 6 inches by 16 feet, and that of the smoking-room 10 feet 6 inches by 12 feet.

The boxes are each 8 feet deep, with a portion of the circle deducted, by 8 feet in width, and the passages leading to the reception-rooms of the boxes are 3 feet 9 inches wide.

The stage is commodious and easy of access to the street, at the right through a passage 10 feet wide, and at the left through the alley or court. The dressing-rooms, in addition to those shown upon this plan adjoining the office, are placed upon the floor above.

THE FIFTH AVENUE THEATRE OF NEW YORK.

This splendid example of modern architecture, the fourth playhouse that has borne that name, is situated upon the north side of West Twenty-eighth Street, a few feet from Broadway, on the site of its namesake, which was burned on January 2, 1891. The Twenty-eighth Street front, which is the broadside of the building, is in the style of the Italian Renaissance, very elaborate in the detail of its ornamentation, in which free use has been made of the emblems of the drama.

The columns of the portico, and the iron structure of the first story back of the portico, are relics of the former building, and were retained by Mr. Francis H. Kimball, the architect, in their original positions, but the cornice and balustrade of the portico are parts of the new work. Above the first story of the new theatre all the ornamental features and cornices are wrought in white terra cotta. The exterior, so elaborate, on the whole, on account of the employment of this medium of terra cotta, while maintaining the exquisitely delicate and graceful characteristics of the period which it represents, expresses in all its constructive details the continuity of an idea strictly in harmony with the purpose of the building.

In a word, it embodies in itself the most appropriate suggestion of the uses of the interior; the grand divisions or principle parts of a theatre, namely, the auditorium and the stage, being illustrated most effectively in the architectural composition, the more elaborate portion representing the auditorium, and the plainer section the stage.

The richness and minute elaboration that such a treatment is susceptible of in clay were never more apparent than in this illustration.

THE FIFTH AVENUE THEATRE, N. Y., TWENTY-EIGHTH STREET FRONT.

FRANCIS H. KIMBALL, ARCHITECT.

THE OLD LANDMARK, FIFTH AVENUE THEATRE.

On either side of the central feature of the balcony foyer are windows, with ornamental terra-cotta panels between, the one denoting comedy, the other tragedy.

Again, the mullions of the windows of the gallery foyer are in the form of caryatides supporting the main cornice, and in the panels of the larger piers are bas-reliefs representing dancing and singing figures, all of these being in terra-cotta.

The leading architectural lines of the Twenty-eighth Street side are carried throughout the entire front, and the stage portion is less elaborate than that of the auditorium just described, calling for but little decoration, comparatively, in terra cotta.

There are two principal entrances to the theatre, one of which is sheltered by the portico and opens into the main foyer, an apartment 40 feet long and 13 feet wide, and from which a wide marble stairway leads to the upper boxes and balcony.

This entrance to the auditorium is no insignificant subject for decorative treatment, and in its treatment the architect has kept well in mind that the "first impressions are everything." The illusion is complete, as this hall in itself has no great length; though well proportioned, it appears twice as long as it otherwise would, had not the mirrors placed there against the east wall been adopted.

The other entrance is through a lobby 50 feet long and 12 feet wide, which leads from Broadway to the rear of the parquette.

Both the entrances are paved with perfectly white Vermont marble, with Tennessee marble borders and plinth under-columns and pilasters, and the walls are divided into panels by pilasters and columns of Mycenium marble.

There is another marble staircase from the parquette to the balcony on the north side of the theatre, and one imme-

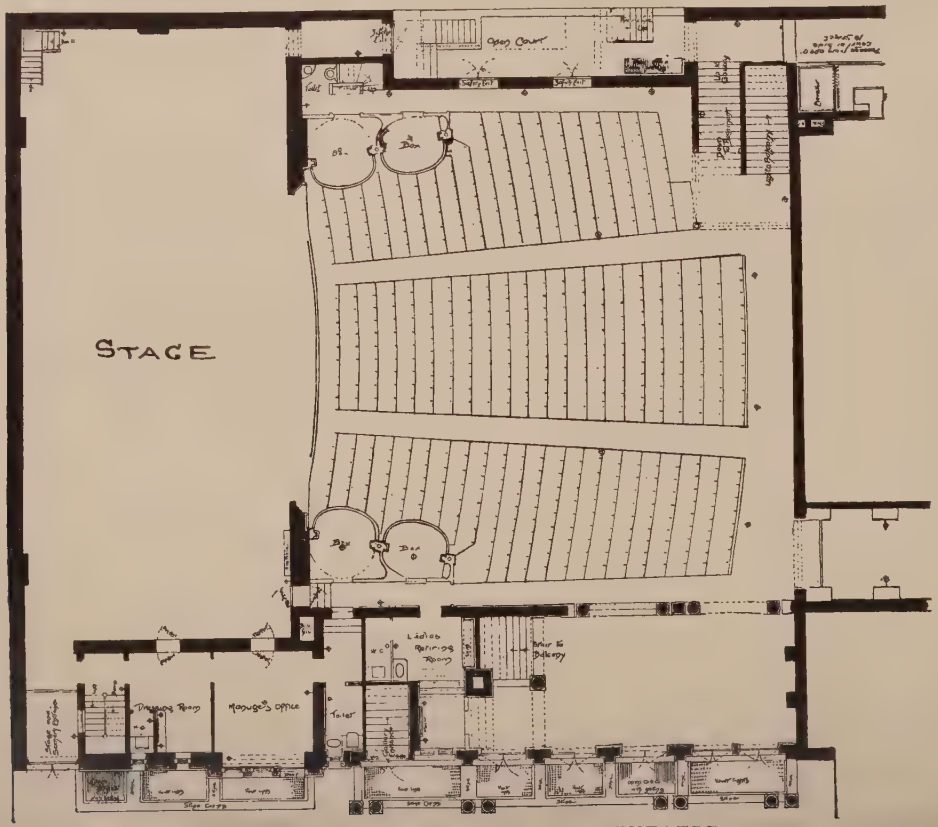
diately under, to the smoking-room and gentlemen's toilet under the auditorium.

Entering the theatre by the regular Broadway entrance, it will be noticeable that the style of the exterior is adhered to throughout entrances, foyers, and auditorium in all its elaborateness. The pilasters along the walls of the entrance represent Sienna marble with capitals of ivory and gold, and the ceiling overhead is vaulted in tile, on which are decorated ribs in plaster relief, the subject of the ornamentation being fruits and flowers, and on the plain surfaces of the walls and ceilngs are frescoed ornaments in color and gold. There are three divisions combined in this entrance: the outer lobby next to the street, with iron enclosing gates, then the box-office lobby, and an inner lobby next to the theatre; the purpose of which divisions being to control the rush of cold air into the theatre when the outer doors are opened.

The main decorative feature of the Twenty-eighth Street foyer is the beautiful coloring which the marble columns and marble wainscoting give that superb wall; and when this is contrasted with the ceiling and side walls, in white and pale pinkish terra cotta, the composition is impressive in its fullest sense.

On entering the auditorium from the foyer of the Fifth Avenue Theatre we are impressed with its cosey and comfortable appearance. The parquette seats 600 people, and the entire seating capacity is 1400.

Growing out of the proscenium boxes of the theatre is the great splay of the proscenium arch, itself panelled and enriched with Italian ornamentation, and from this springs the dome, beginning from a heavy cornice as a base and supporting heavy ribs arranged in pairs. Among the most charming decorative features of the auditorium is the drop-curtain, part of which is shown, painted by H. Logan Reid, after the original by Cottazzo, " The Crowning of the Bride,"


STAGE
Orch. Court
Ladies Retiring Room
Manager's Office
Director's Room
Stage Carpp.

TWENTY-EIGHTH STREET FOYER, FIFTH AVENUE THEATRE.

BROADWAY ENTRANCE, FIFTH AVENUE THEATRE.

described and illustrated by Henry M. Stevens in an article entitled "The Fifth Avenue Theatre," published in the *Scientific American*, July number 1893. Mr. Stevens says it is "A souvenir of the happy days of Louis XVI. The scene itself is one of considerable magnitude and introduces a large number of figures. The atmosphere of old French court life, and the simplicity of the country custom of the time, in which a provincial bride and groom seek distinction at the hands of Louis and his beautiful consort, Marie Antoinette, through a graceful ceremony of this coronation, are most attractively and truthfully portrayed."

By taking another glance at the auditorium we see the same general idea of design and tints displayed with equally good taste throughout the minor details. The acoustic properties are perfect and the lines of sighting of the parquette and upper tiers are carried out in the same manner as described under the remarks upon these subjects hereafter.

Symmetrical planning is to our mind the first necessity for any theatre that is to be a safe one. The position of all passages and staircases, the nearness of all exits to these essential parts and to the outer air are, all-important. The front of the site, as well as the sides looking on the thoroughfare, is of course a great advantage. In this particular but a few feet separates the auditorium from the street, and the building, in case of any emergency, could be emptied of its audience in at least two and one half minutes, even that portion occupying its farthest seats.

The Fifth Avenue is about the size of the Empire Theatre, but adjoining its 1400 seats plenty of room is allowed for aisles and passages. The seats are comfortable and elegantly upholstered.

The stage occupies a space 35 feet wide by 80 feet long upon the main floor, and adjoining is one dressing-room, the

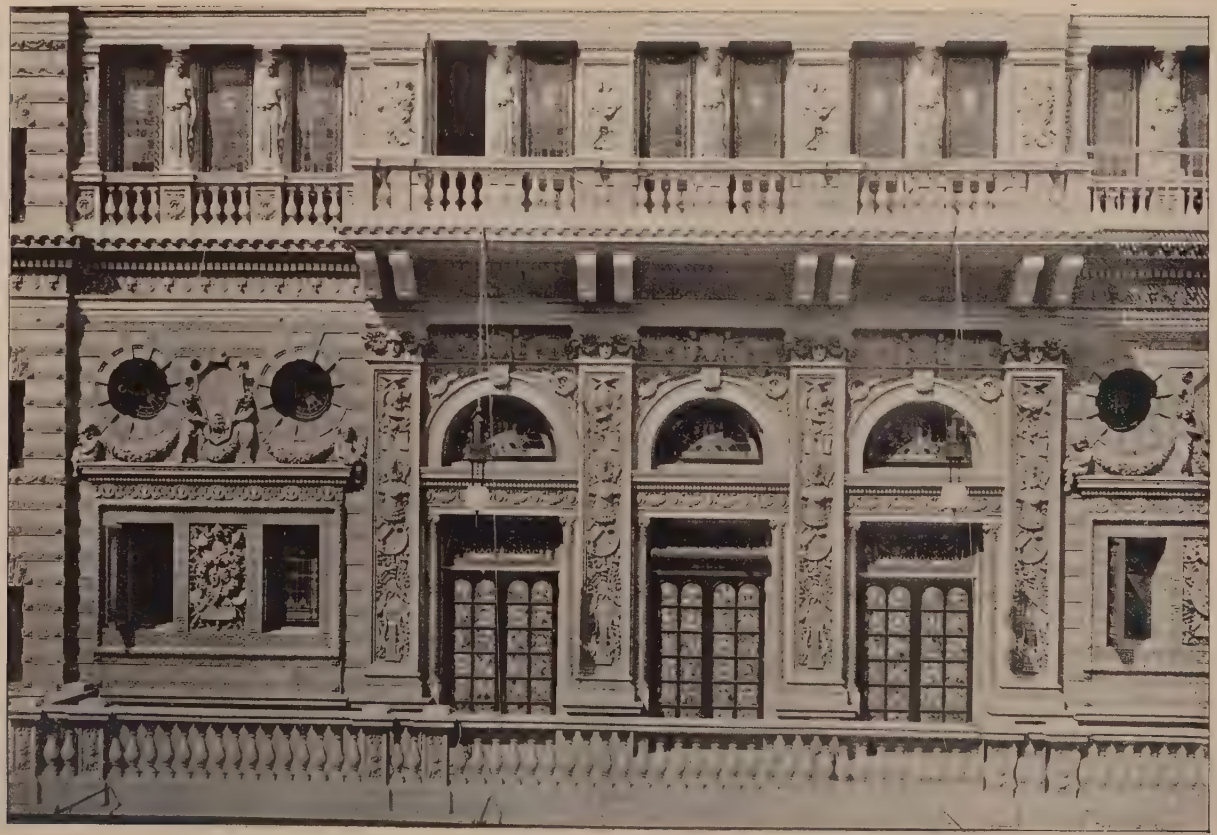
manager's room, and a large passage leading to Twenty-eighth Street (the other dressing-rooms are above the stage). There are eight boxes, a balcony, and a gallery extending well forward.

The auditorium is 68 feet wide by 64 feet deep and 65 feet to the dome.

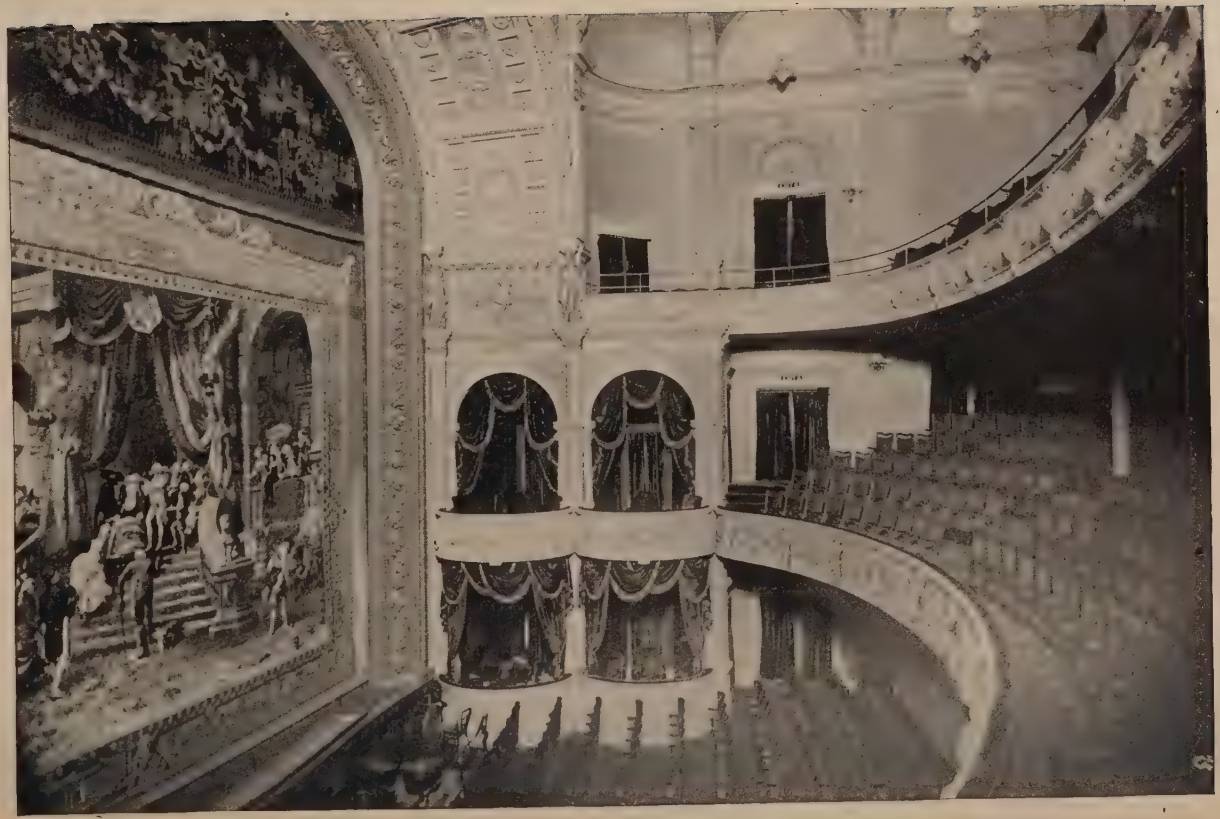
The stage is also entered upon the right through an open court, containing fire-escapes, and balconies built of iron, which extend to the upper tiers and in case of emergency are used as exits leading to Broadway through a wide passage. The theatre is fully equipped with approved fire-apparatus, the construction throughout is of iron and steel with Guastavino arches in the floors, and the building is lighted by electricity.

As in the old system of lighting a stage by gas a gas-plate was needed, with the taps labelled as to the portion of the system they governed, so for the electric system a switch-board is used, containing all the necessary switches, cut-outs, and other fittings for the control and regulation of the stage-lighting. This switchboard is fixed in a convenient position overlooking the stage, and is accessible only to the person employed to operate it.

The entire scenery has been treated by the " Martin Process " of fireproofing, a description of which will be given later on.



DETAIL OF TWENTY-EIGHTH STREET FRONT, FIFTH AVENUE THEATRE



THE AMERICAN THEATRE.

The American Theatre, situated on the southeast corner of Eighth Avenue and West Forty-second Street, New York City, as designed and constructed by Charles C. Haight, architect, presents to us an example of the newest of the great places of amusements in which New York delights.

It was opened for the first time in 1893, and attained at once great popularity.

The theatre proper covers a plot of ground 100 feet by 98 feet 9 inches, with three fronts upon three different streets. The photo-plate shows the Forty-first Street front with entrances to the foyer, balcony, gallery, and stage. The other two fronts face Eighth Avenue and Forty-second Street respectively, and are used also as entrances to the foyer. The Forty-second Street entrance contains stairways leading to balcony and gallery. The architecture of the exterior is simple and effective, showing at once that the design has been well studied, and carried out with neatness and precision.

In the decoration of the auditorium and throughout the interior of other portions of the building the same taste has been exercised as in the front, the colors of which are in warm tints.

In the construction of the auditorium particular care has been taken to provide a system by which each spectator commands a good view of the performers.

Some of the important provisions for the safety of the public against fire are wide and easy staircases, large outside fire-escapes, open courts, and an abundance of exit doors; fire-extinguishers, fire-curtain, and skylights constructed to fly open automatically. Iron and concrete enter largely into the entire construction of the building.

A feature of the American Theatre is its roof-garden, which is constructed upon heavy iron girders over the auditorium, where in hot weather one may partake of refreshments and listen to the orchestral music.

The garden, as well as the rest of the entire building, is brilliantly lighted with electricity, and is reached by elevators and stairways.

The elevator-shafts are constructed of solid masonry walls, having openings leading into the different galleries, the auditorium, and foyer. The elevators are used by the audience at the beginning and close of each performance.

The auditorium will accommodate, in seats which are comfortably arranged, about 2500 persons.

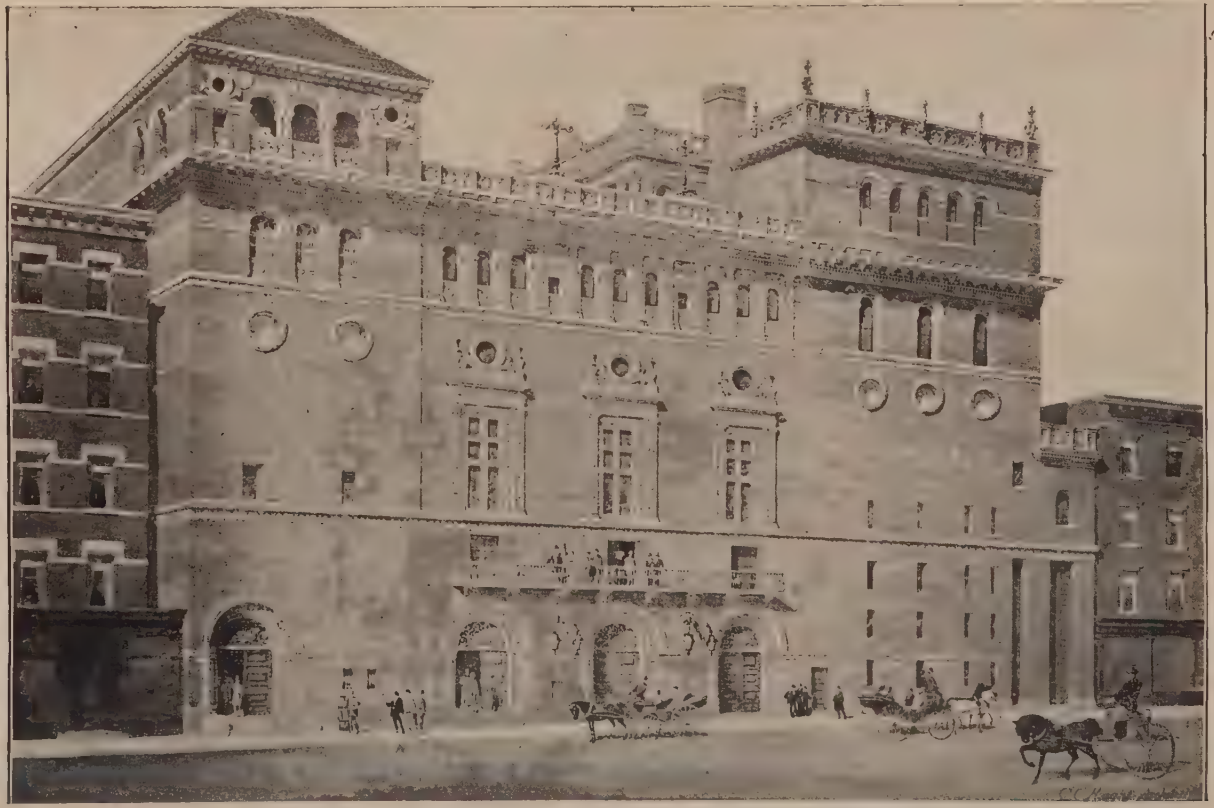
The ground-floor plan clearly shows the entire arrangement of the entrances and lower portions of the building. The passage from Eighth Avenue is 19 feet 8 inches wide, and that from Forty-second Street 15 feet 8 inches; the lobby at the end of these two passages being 18 feet 6 inches in diameter.

The foyer is 14 feet 6 inches wide at its narrowest part, by about 60 feet long.

The distance from the curtain to the rear is 74 feet 6 inches by 74 feet 5 inches wide, and the height of the auditorium from the stage level to the top of the dome is about 70 feet.

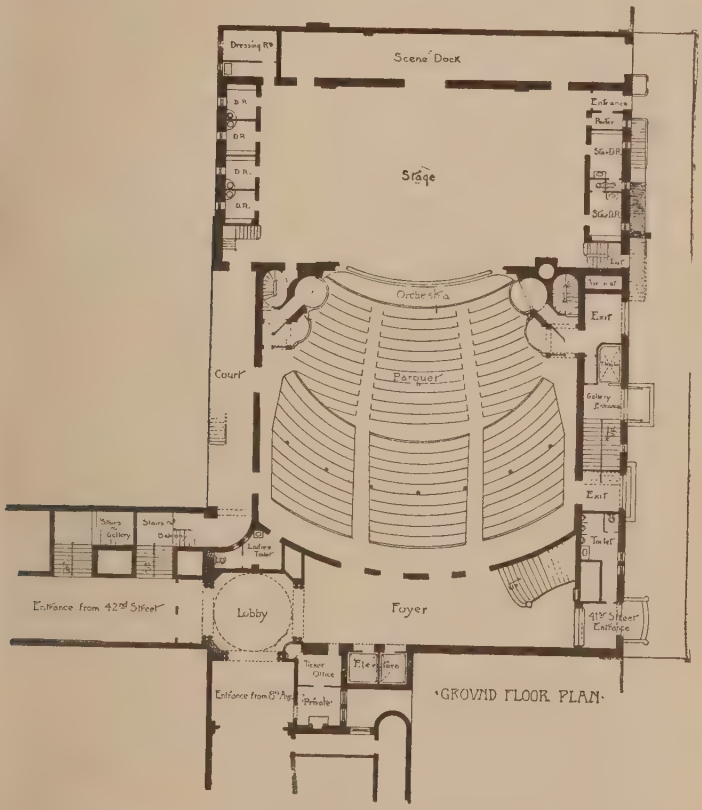
From a point on the centre-line, 7 feet 4 inches from the curtain, a radius of 34 feet describes the rail which separates the parquette from the parquette circle. Each successive row of seats in the circle, 2 feet 7 inches wide, is described from the same point, allowance being made for an aisle 6 feet 3 inches wide at the back.

The steppings of the parquette are described by a radius of 31 feet 8 inches to a point on the centre-line back from the curtain, each row being the same width as those of the circle.



EIGHTH-AVENUE FRONT OF THE AMERICAN THEATRE.

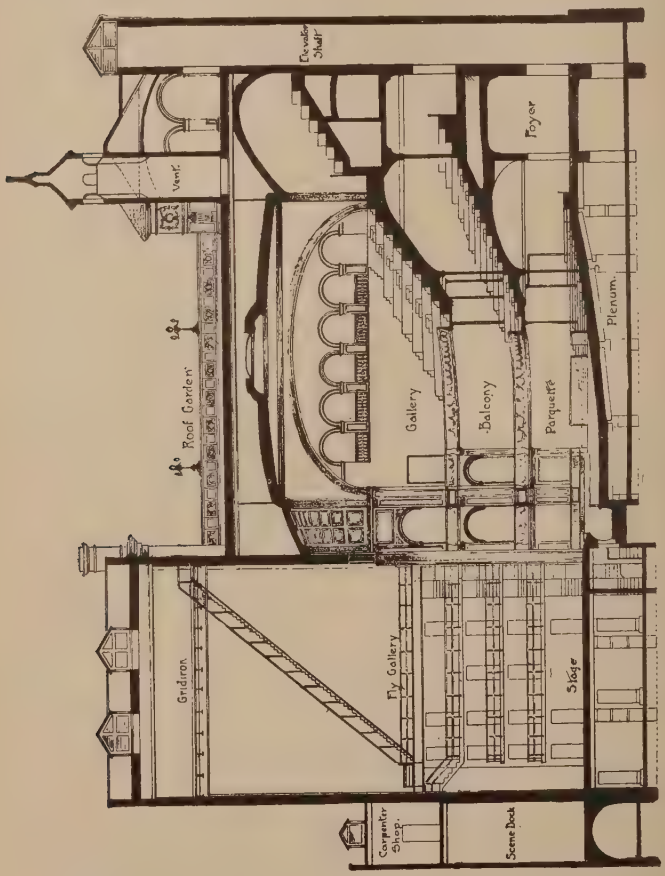
In addition to the main entrances to the foyer there are in this portion of the house four exits on each side, two leading to an open court and the other two leading to Forty-first Street.



The stage with its galleries, and the proportions of the auditorium, are shown in the section.

The proscenium opening is 39 feet wide by 39 feet high. The stage is 43 feet 4 inches deep by 77 feet 9 inches wide, and 73 feet 6 inches to the gridiron.

There are seven small dressing-rooms, fitted up with toilets and every convenience, opening upon the stage level, two of which are for star actors.



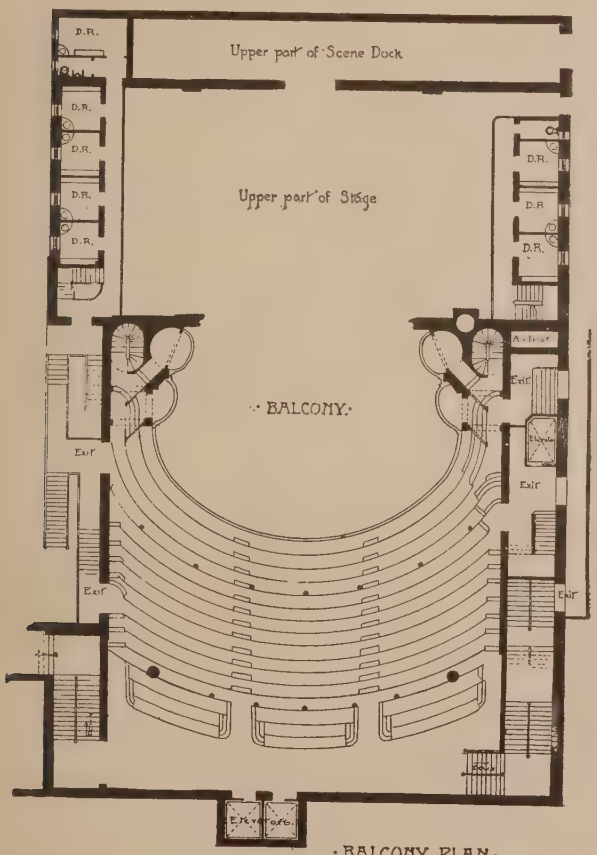
LONGITUDINAL SECTION.

Directly back of the stage is placed the scene-dock, 11 feet 4 inches wide by 25 feet 8 inches clear height, for the storage of scenery used in large spectacular plays.

Under the entire stage and not shown in any of the

illustrations are spacious rooms used for various purposes, such as bill-rooms, toilets for stage hands, orchestra, etc.

The balcony, being directly over the parquette circle, is

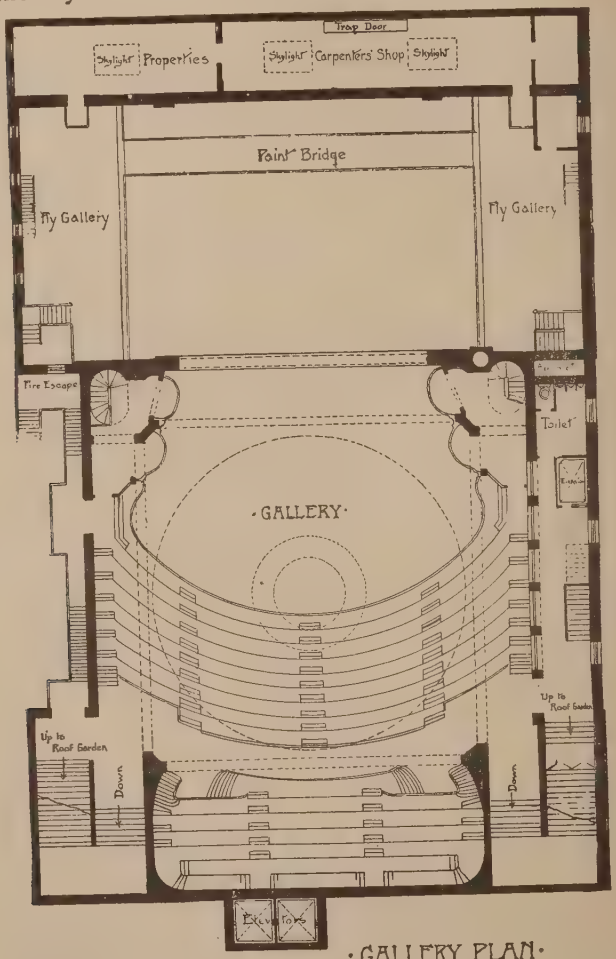


BALCONY PLAN.

somewhat similar in plan, with the exception that the four rear rows of seats are raised above the balcony-level.

The four emergency exits shown upon the plan lead to the outside fire-escapes. All the dressing-rooms above the

stage-level, some of which are also shown in the plan, are reached by iron and slate stairways.



GALLERY PLAN.

The height of the balcony is 21 feet from the foyer floor-level, being 9 feet 1½ inches to the first stepping; eleven steppings take up the remaining height of 10 feet 10½ inches.

The first fly-gallery is 8 feet 9 inches from the stage, the second 7 feet 9 inches, and the third 7 feet 9 inches from the second.

The front of gallery and stepping as shown by the plan of gallery are described by a radius 38 feet 10 inches from a point on the centre-line 5 feet 4 inches from the curtain. The steppings are all 2 feet 6 inches wide, the height of the first being $17\frac{1}{4}$ inches, the second $18\frac{1}{4}$, the last at the gallery-level, $20\frac{1}{4}$ inches, making 14 feet $6\frac{3}{8}$ inches, or 16 feet from the balcony-level.

From the 16-foot level at the back of the gallery there is a passage 6 feet 4 inches wide, and placed above this passage there are six rows of seats 2 feet 6 inches wide, from $18\frac{7}{8}$ inches to $20\frac{7}{8}$ inches in height.

The halls of this gallery leading to the main stairways are 8 feet 6 inches wide, and the doors leading to the fire-escape stairs are 6 feet wide.

It is also possible, by the arrangement of steppings, to reach the lower floor by the circular stairs at the rear of the six boxes.

The stage side of the auditorium at the gallery-level contains the paint-bridge, the two large fly-galleries, and the carpenter-shop.

All the heating, ventilating, and lighting appliances known to the mechanics' world are placed in this theatre. In designing the ventilating plant no expense was spared to make the system a perfect one.

The theatre is heated mainly by the indirect system, while a few direct-heating radiators are placed in the dressing-rooms, lobby, and the rear of the stage, where the heated air that is blown into the body of the theatre would not be liable to penetrate.

There are about 1400 square feet of heating surface of direct radiators in the building, and about 2500 square feet

of heating surface in especially designed coils for the heating-chamber in the basement. About 2,000,000 cubic feet of air per hour is drawn from the heating-chamber by the fan and forced into the theatre, thus giving about 660 cubic feet per person per hour, assuming the theatre to hold 3000 persons.

The fresh air for the indirect system enters by a loggia or open gallery near the roof, and descends to the heating-chamber in the basement by means of an $8\frac{1}{2}' \times 3'$ duct. An iron damper, placed in the duct and controlled from the heating-chamber, prevents an upward current when the fan is at rest.

The air enters at one end of the chamber near the floor, and, rising, passes between the inclined coils to the fan.

There is, however, an unobstructed passage at one side of the coils, which allows the greater part of the air to pass directly to the fan. This passage can be closed by a switch-valve or door swinging on a vertical axis, and by the partial opening or closing of this door the temperature of the air entering the theatre can be regulated.

The coils also being in separate sections, each controlled by a valve, allows the operator to use any number at a given time. An opening through the wall of the coil-chamber allows the passage of air to the plenum-chamber.

A cone-wheel fan 8 feet in diameter is placed opposite the opening above mentioned, the shaft carrying the fan being supported by a pillow-and-spider bearing, the fan being driven by a belt from a $9'' \times 10''$ engine.

The plenum-chamber, as shown on the section, occupies all the space in the basement under the auditorium, the air being delivered to the parquette and circle by means of 341 openings under the seats, the same method being used for the balcony. These openings are approximately under every seat in the lower floor and every third seat in the balcony, a

hood being placed over each opening to diffuse the air for the comfort of the occupant, each opening having a sectional area of seven square inches. The air is carried to the balcony from the plenum-chamber by vertical ducts built in the walls of the auditorium, the largest of which has a sectional area of 16 square feet, and also supply fresh air to the main halls. Radiators, or what may be termed secondary coils, are placed in branch ducts to increase the temperature of the air supplied to the halls.

The foul air is taken from under the galleries by horizontal ducts leading to vertical ones, and finally combine and form one circular flue 30 inches in diameter.

The greatest volume of foul air from the auditorium ceiling-bell is carried by a horizontal duct leading to a vertical flue having a sectional area of 24 square feet, supplied with damper and controlled by the engineer.

HEATING AND VENTILATION.

Heating and ventilation are branches of science which have received thus far a general acknowledgment, embodying principles of the greatest importance.

The ordinary comprehension of ventilation as applied to theatres is the introduction of fresh air and the simultaneous removal of vitiated air. Air when once passed through the human system is unfit for reinspiration, that portion which is emitted being not only useless, but deleterious to health. On this account it becomes necessary to remove this vitiated air and to substitute fresh air, which should be at a temperature of 60° to 65°. The vitiated air on being exhaled has a temperature between 80° and 90°, and, being thereby rarefied and rendered lighter, has a tendency to rise.

The fact is, of course, a constant continuous mingling of the vitiated and the fresh air, depending somewhat on their relative temperatures and densities, but mainly on the abso-

lute motion of the air in the room. A process of dilution of the vitiated air exhaled by man and the air in the room is constantly going on, and the fresh-air supply must be adequate to keep the air breathed by the inmates at a proper standard of purity.

We have no mode of measuring the mixed quantities of impurities in the air with precision. To come to any near approximation we must first calculate the amount of carbonic acid contained in the air, and allow that the *quantum* of the organic impurities are proportional to it.

We are informed by the best hygienists that a room to be properly ventilated should not exceed by volume 6 to 8 parts of carbonic acid in the air. When the proportion rises above six—possibly eight—the disagreeable odor experienced by every one who, coming from the fresh external atmosphere, enters a crowded and inadequately ventilated room becomes perceptible.

We are also informed that although, in poorly ventilated quarters the proportion rises as high as 80 parts in 10,000, no room is properly ventilated in which the proportion is higher than 6 in 10,000, or sometimes 8.

Mr. A. R. Wolff, M.E., states in his treatise on ventilation that an ordinary man exhales .6 of a cubic foot of carbonic acid per hour. New York gas gives out 0.75 of a cubic foot of carbonic acid for each cubic foot of gas burnt, or for a 4½-foot burner 3⅜ cubic feet per hour. An ordinary lamp gives out 1 cubic foot per hour. An ordinary candle gives 0.3 cubic foot per hour. To express it mathematically, one ordinary gaslight equals in vitiating effect about 5½ men, an ordinary lamp 1⅛ men, and an ordinary candle man.

To appreciate the importance of this it is but necessary to recognize that an air-supply ample for six men when there is no lighting, would be sufficient for one man when the room is lit by a single gas-burner.

And furthermore, the value of an incandescent electric light as an illuminant, in which no vitiation of the atmosphere is caused, is at once evident.

Pure country air contains about 4 parts of carbonic acid in 10,000. Hygienists calculate that 3000 cubic feet of fresh air should be supplied by systematic ventilation per hour to each person. In theatres and large auditoriums, in which the cubic space per individual is great, this may be considerably reduced.

Pure air penetrates in many ways. Windows, doors, and even brick walls, all permit the entrance of the external air, and thus without a systematic air-supply a large amount of external air enters to purify the air in the room.

In theatres where the air enters through the steppings of the galleries and auditorium, and where it can be made to enter through apertures in the decoration, it is a comparatively simple matter to supply from one to two thousand feet per hour to each person at a low velocity, the quantity of fresh air supplied being conditioned on the removal of the same amount of air from the building.

The most active circulation and removal of air by vent-ducts are produced by exhaust fans and blowers. Indeed, for theatres especially, reliance should be placed either on bringing in the fresh-air supply under pressure by means of blowers, or by attaching exhaust fans to the vent-ducts to create a current within them, or a combination of both systems may be arranged.

The ordinary ratings of blowers supplied by the trade range from wheels 4 feet in diameter, with 350 revolutions per minute, and 10,635 cubic feet per minute, to wheels 15 feet in diameter, with 100 revolutions and 160,000 cubic feet per minute.

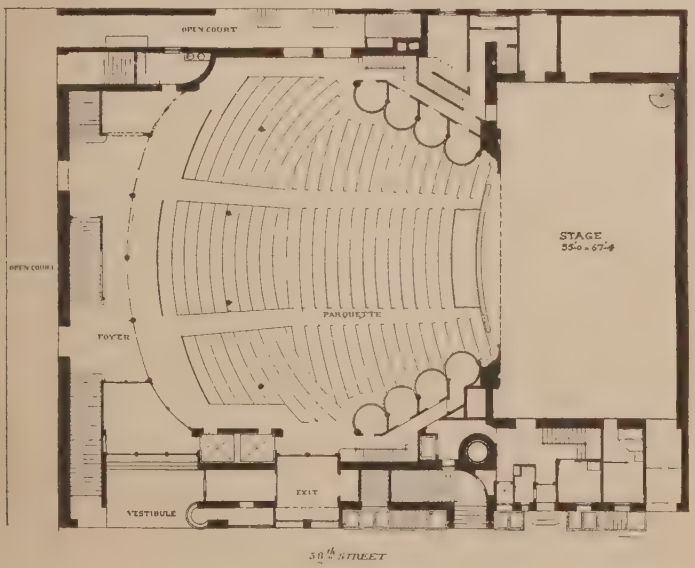
PROCTOR'S PLEASURE PALACE.

In the heart of the upper east side shopping district of New York a magnificent theatre has been designed and constructed by J. B. McElfatrick & Son, architects. The theatre is known by the name of "Proctor's Pleasure Palace," and stands upon the south side of Fifty-eighth Street, between Third and Lexington avenues. For its support it has many thousands of people to draw from, being the only pretentious place of amusement between Harlem and the lower portion of the city upon the east side. It is between two immense arteries of travel traversed by cable cars and the elevated railway, with ample cross-town communication. Magnificent hotels which beautify the plaza at the main entrance to Central Park, and the marble palaces of the Fifth Avenue dwellers, are close at hand. Within a stone's throw are luxurious club-houses of the principal German societies. Upon the north and east is an enormous population that before had been compelled to seek its amusement at remoter resorts. There is much to attract all classes, for in this new house of amusement there are combined the theatre proper, roof-garden, German café, Garden of Palms, and other adjuncts. It is devoted to the latest fad in theatre performances of this country—continuous varieties and novelties, which continue from 12 o'clock noon until 11.30 P.M.

The roof-garden is very large and commands a superb view, stretching across Central Park on the west and over the East River. Below the main auditorium is the German café, with a stage where vaudeville is presented at the close of the performance above and also at intermissions, when refreshments are served. Adjoining the theatre is the Garden of Palms, 65 by 100 feet—not shown in the illustrations—where

FIFTY-EIGHTH STREET FRONT, PROCTOR'S PLEASURE PALACE.

distinct musical programmes and exhibits are given, while beneath this is the divan, to be gorgeously fitted up in Oriental fashion, with the convenient adjuncts of library, writing-room and stands for the sale of flowers, books, papers, Turkish coffee and other light refreshments. Even a barber-shop and boot-blacking stand will occupy a convenient corner, with a plunge-bath also near at hand. A moderate

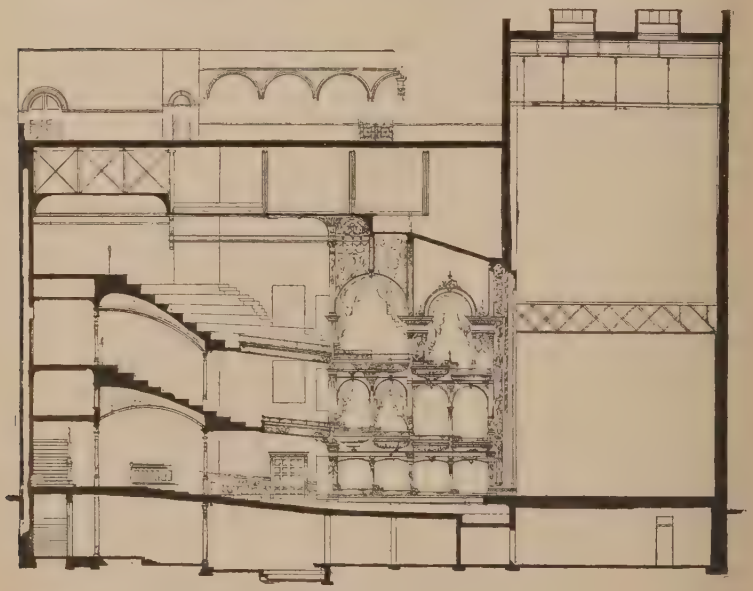


MAIN-FLOOR PLAN.

admission price allows a visitor to range at will throughout the entire building and witness all the entertainments.

The frontage is on Fifty-eighth Street, extending 200 feet, with a depth of 100 feet 9 inches. The architecture combines the most picturesque features of the Romanesque and Renaissance styles. The main entrance, at the end nearest Third Avenue, is through a spacious stone arch 24 feet wide by 30 feet high, with a large balustrade overhead.

The main auditorium is reached through a vestibule and lobby paved in mosaic tile, with three huge oaken doors, arched and illuminated with art glass, opening upon a foyer 60 feet in length and shown upon the ground-floor plan. The vestibule mentioned above has an entrance over 6 feet in width leading to the German café in the basement, and another from Fifty-eighth Street, over 5 feet wide, also leads to the café.



LONGITUDINAL SECTION.

The ground-floor, in addition to the entrances, contains foyer, parquette, and parquette circle, eight boxes, manager's room, toilets, box-office, and superintendent's office.

There are upon this floor five emergency exits: two at the back of the foyer, 6 feet wide, leading to an open court 10 feet wide, two upon the left to the same court, and one large exit, 12 feet wide, leading through a corridor to Fifty-eighth

Street. The various stairways which lead to all portions of the building are very large. Those in the foyer are entrances to the balcony above, and the one in the centre to the café below. These staircases are constructed of white marble upon stringers of steel, guarded and ornamented with bronze hand-rails and wrought-iron scroll balustrades.

Two large passenger-elevators, each accommodating thirty people, run constantly from basement to roof, landing at each floor.

The parquette and circle, from curtain-line to line of column in foyer, is 74 feet 4 inches by 74 feet 6 inches wide, and the height of the auditorium from the stage level to the top is 49 feet 8 inches.

From a point on the centre-line of the auditorium 6 feet from the curtain, a radius of 39 feet 5 inches describes the first steppings of the parquette circle. Each successive row of seats, 2 feet 6 inches wide, is described from the same point.

The seats of the parquette are placed upon the floor with a gradual slope of 18 inches toward the orchestra-pit, and arranged in rows 2 feet 6 inches apart, described from a point on the centre-line 50 feet 4 inches back of the curtain.

The four boxes upon each side of the parquette are 7 feet in diameter, arranged in tiers as shown upon the section, and reached through small doors from a passage 2 feet 9 inches wide.

The proscenium arch, with elaborately moulded relief work, is dotted with colored electric lights. A distinct novelty is adopted here; it is what may be called a "double proscenium." One reveals an opening of 34 feet square, sufficient for ordinary performances, made to slide up in side grooves, leaving an opening 42 feet square should the stage be required for grand spectacular display. The sounding-board is covered with mythological figures painted upon canvas secured to a

coved iron frame, filled in between with hollow fire-proof blocks.

The stage is 70 feet wide and 40 feet deep, 30 feet to the fly-gallery and 40 feet additional to the gridiron. It is fitted up with every known species of trap and the latest labor-saving devices. It is suited to every form of performance—grand opera, romantic drama, spectacle, or vaudeville.

At the back is a movable iron door (not shown upon the illustrations) made impervious to sound, which can be opened upon the stage in the adjacent Garden of Palms. Certain features, acrobatical, spectacular, or zoölogical, as for example performing elephants, can be exhibited upon this combined stage and viewed simultaneously by two distinct audiences that will face each other. In fact, the stage can, if necessary, be extended back the entire width of the garden. The stage also has its scene-room, property-room, entrances, and freight-elevators to the roof.

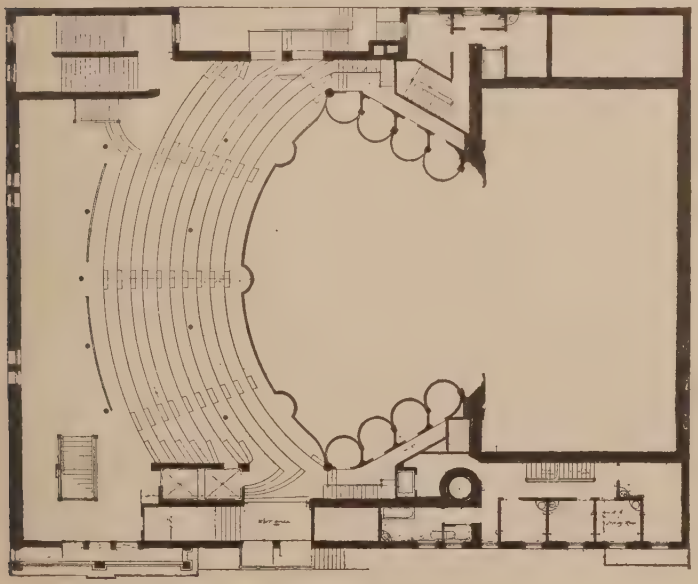
The dressing-rooms are cool, spacious, and fitted up with marble lavatories and electric-call bells.

Under the stage and rooms mentioned above is placed the machinery hall, containing the boilers, dynamos, and engines. The house is heated by the direct-blower system; fresh air is brought through an inlet 4 feet square, rising to 8 feet above the roof. Every appliance for cooling the auditorium in the summer has been provided. The theatre has 4000 electric lights, of which 600 are used upon the stage for illuminating and spectacular effects.

The balcony is 21 feet 9 inches above the foyer-level, and is reached by four staircases well arranged and commodious. The emergency exits all lead to the fire-escapes. To arrange the steppings of this circle a radius of 39 feet 1 inch was taken from a point upon the centre, 6 feet from the curtain-line; each step above the first is 2 feet 6 inches wide by 10½ inches high; each successive rise increases ½ inch up to 17 inches.

The first or lower step is 2 feet 10 inches wide, bowed out in front of the centre aisles and at other points each side.

One prominent feature is shown upon this plan which needs particular mention, and that is the large outside balcony at the Fifty-eighth Street side at rear of the seats. In case a fire occurs in the theatre these balconies become a valuable means of egress for the audience and ingress for the firemen. Out-



BALCONY PLAN.

side balconies should be placed to every tier leading from the different galleries, and every division of the audience should have different accommodations.

Some one has said that "a theatre should be divided into four separate and distinct buildings, separated by substantial brick walls rising above the roof, and all communications be cut off by the best known fire-resisting means." First, there should be a fire-proof auditorium; second, a stage building;

third, a fire-proof building for dressing-rooms, etc.; and fourth, a fire-proof storage-room for scenery, properties, etc., with double fire-proof doors; and all the four buildings provided with large separate exits to the open air—we might say six different buildings, for, as we have seen, the lower floor is separate and distinct from the balcony and gallery.

The dressing-rooms, as shown upon this plan, are seven in number, separated by heavy masonry walls from any other portion of the building. They are reached by staircases constructed of iron and slate, 3 feet wide and of short runs. The smallest of these dressing-rooms contain 64 square feet, arranged with windows opening upon the outer air and connecting with balconies and fire-escapes. There are also small elevators in close proximity.

The boxes, four in number on each side of the auditorium, have separate iron staircases.

The gallery over the balcony does not extend as far into the auditorium, but is described from the same point, 42 feet 8 inches distant, the first step being 2 feet 10 inches wide, while the successive steps in the height are each 2 feet 6 inches wide.

The height from the balcony is 16 feet 1 inch, and the clear distance between fronts at inner line of columns is 10 feet 3 inches, while the balcony at this point from the parquette circle is about the same distance.

The rise of the steps on this tier at the centre varies from 17 inches for the lower to 21 inches for the upper, increasing in height as the sides of the auditorium are reached.

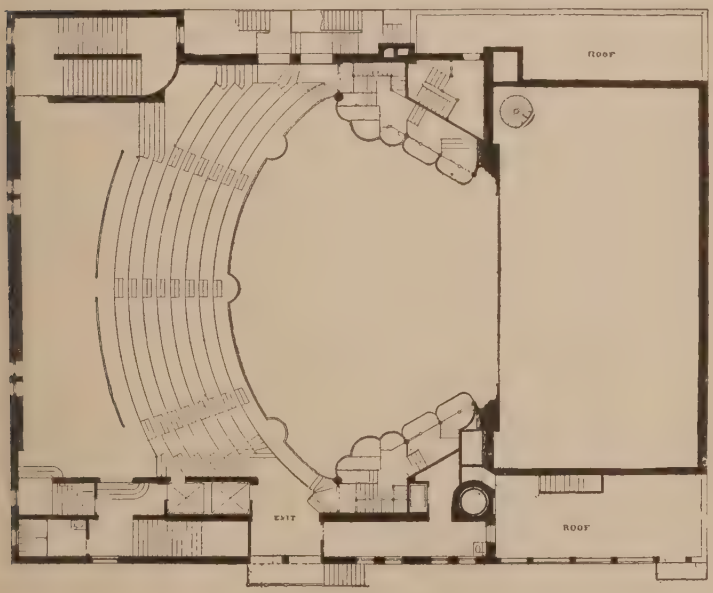
The equipment of this theatre leaves nothing to be desired. The lower floors, balcony, and gallery all have ample toilet-rooms; comfortable upholstered chairs are provided for every occupant regardless of location.

Altogether there are some fifty exits, directly connected to wide, open courts, fire-escapes, and the street. The fire-

escapes arranged upon the Fifty-eighth Street side are so ingeniously devised that they do not mar the architectural effect.

The aisles throughout are plentiful and wide, with no intersecting gangways and not over ten or twelve seats in every row between aisles.

The corridors behind each tier of seats have sufficient super-



GALLERY PLAN.

ficial area to hold the whole of the occupants of each tier. But the writer would suggest that the corridors be separated from each tier by solid masonry walls and fire-proof doorways, so that in case of fire the audience, after leaving the tier, would be away from any fire or smoke that fills the auditorium.

As shown in the plans all staircases are wide and have

large square landings with no windows, and are constructed between solid brick walls.

In staircases the number of steps in each flight is all-important. There should not be over twelve steps in a run, and they should be the same width of passage, height of rise, and width of tread.

While we are attracted by the general roominess of every portion of the building, we are also impressed with the simplicity and neatness of the decoration, gold, cream, and pale blue predominating.

The entire seating capacity of the theatre proper is about 2100.

BROADWAY FRONT, HAMMERSTEIN'S OLYMPIA.

J. B. McElfatrick & Son, Architects.

HAMMERSTEIN'S OLYMPIA.

In the short space of ten months, beginning with February 1895, the large and magnificent amusement palace situated at Forty-fourth street and Broadway, New York, was opened to the public on November 25th.

The building has a frontage of 203 feet on Broadway, 156 feet on Forty-fifth Street, and a little less on Forty-fourth Street. The greatest height of the building is 96 feet at the centre of the Broadway side. The architecture follows the lines of the French Renaissance period.

"Olympia" comprises three spacious auditoriums, as shown by the plans, under one roof, known as Olympia Music Hall, Olympia Concert Hall, and Olympia Theatre, where three distinct entertainments are given nightly, one admission-fee admitting to all.

In addition to the above auditoriums there will be a roof-garden with complete stage appointments and a level floor-space almost equal to the surface dimensions of the entire building and capable of seating several thousand persons.

Below the street-level there are cafés, billiard-rooms, bowling-alleys, and Turkish baths.

The edifice is fire-proof and strictly complies with the laws of the Building and Fire Departments.

No wood or inflammable material has been used in the structural portion, excepting in some parts over concreted floors. It is provided with ample means of escape in case of fire or panic, and has numerous exits on every floor front and back of the curtain-line. Automatic sprinklers are distributed over all the auditoriums, stages, fly-galleries, and dressing-rooms, and at any point the building can be deluged should the temperature reach an abnormal degree.

The building is heated and ventilated by the rotary-fan

process, which forces hot and cold air through ducts, and permits an even temperature at all times, no matter what the climatic conditions may be or how densely the auditoriums may be crowded. The same process drives impure air from the various auditoriums through the openings placed above the ceilings.

Olympia is lighted by electricity supplied by four large dynamos operated from vaults underneath the sidewalk.

The music hall is on the Forty-fifth Street side, occupying a frontage on Broadway of about 75 feet; the concert hall is in the centre, and the theatre is on the Forty-fourth Street end. The main entrance to the three auditoriums, as shown by the plan, is through two massive carved doorways on the street-level in the centre of the Broadway front, leading to the marble foyer. In the centre of the foyer there are two immense passenger-elevators, which run to the upper floors and the roof-garden. To the right and left are marble staircases leading to the balconies and box-tiers of the music hall and theatre.

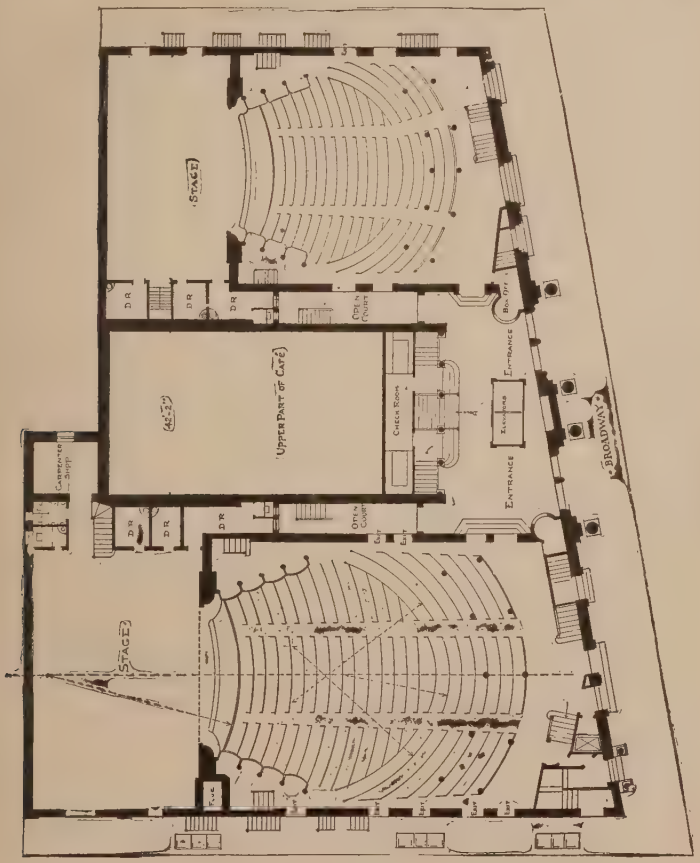
The dimensions of the music hall are: auditorium, 70×100 feet; stage, 43×70 feet; proscenium opening, 36×36 feet; height to rigging-loft, 80 feet; height to fly-gallery, 30 feet.

The stage is well stocked with scenery calculated to meet all requirements.

The dressing-rooms are numerous, well lighted, heated, and ventilated, and are a luxury compared with those usually provided in the average playhouse.

Ample provision has been made for seating in the music hall. There are six tiers of boxes and five tiers of mezzanine boxes, making a total of 124, the largest number known of any single place of amusement. The box-tiers and balconies, while not too far removed from the stage, do not overshadow the orchestra, and are so encircled as to allow freedom

of space in the auditorium, which cannot fail to be agreeable to the occupants of boxes, as well as those in the chairs below. The concert hall is 85 feet long, 43 feet wide, and



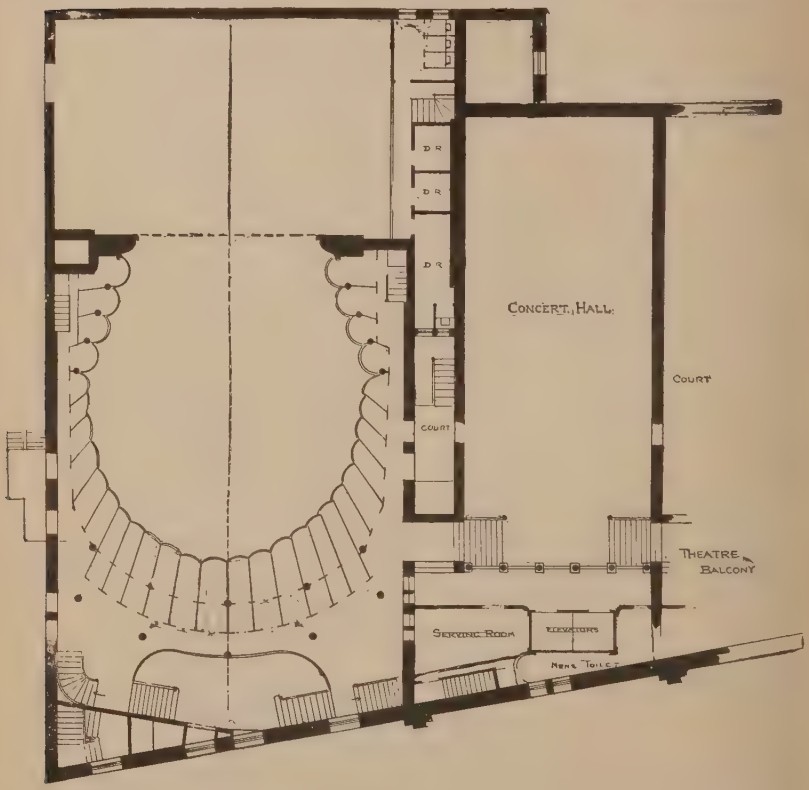
MAIN-FLOOR PLAN.

45 feet in height. It is in the centre between the music hall and theatre, separated by courtyards, and is on a level with the first balcony tiers, as shown on plan.

The theatre, situated at the south end, has a seating ca-

pacity less than the music hall, although it contains eighty-four boxes.

The decorative scheme is blue and gold, in the softest



BALCONY-FLOOR PLAN.

tints and most delicate color effects. Carpets, chairs, and hangings are all blue.

Back of the footlights everything is as complete as human ingenuity could make it. The dimensions of the theatre are as follows: auditorium, 60×68 feet; proscenium opening, 32×32 feet; stage, 31×60 feet; height to rigging-loft, 80

feet; height to fly-gallery, 30 feet. The general arrangement of the different balconies is shown by the section.

The stucco work used in the interior decoration of the entire building is one of the beautiful and artistic features of this immense amusement temple. The sculptural groups, figures, and designs which decorate the boxes and prosceniums in the various auditoriums make the interior appear very attractive.

The designs were made after the style in vogue during the reigns of Louis XIV., Louis XV., and Louis XVI., and living models were employed for the life-size groups and figures. In the decorative scheme that has been followed the music hall is Louis XIV., the concert hall Louis XV., and the theatre Louis XVI.

The music hall is highly decorated. The walls and ceilings are rich in panels of beautiful designs. A massive chandelier depends from a rosette surrounded by dancing cupids. A heroic female figure upholds the forty-eight boxes, which are all different in design.

The proscenium panels, as technically described by decorators, are round form at top and bottom, with a slight square break, with motifs in relief ornamenting the base, the middle and top having a bold cartouche with hanging laurel pendants at either side. The carved and undulating Louis XIV. lines are easily recognized in the lyre crossed by two flutes which appear to grow from the top of the cartouche.

The base is decorated with a rich design, a semi bas-relief, consisting of an ornamental pedestal on which rests a vase with dolphin handles. Japanese dragons crouch at each side of the base.

The panel is surmounted with a female head at the top, decidedly "French" in its expression, on whose forehead rests a star, with festoons of flowers hanging at either side. Below this will be found suspended by cupid's chains an

emblem, of which a classic shield, cupid's bow, arrows, etc., form its composition. Its alternate strong and low reliefs and soft lines, with plain grounds well distributed, at once betray to the layman the quality of its execution. The main group over the proscenium arch represents Poetry and Prose being crowned by the goddess Fame. Its dimensions are 24 × 10 feet.

A panel of cupids forms the frieze extending all around the concert hall. In the decorative scheme here cupids, lutes, lyres, etc., all figure prominently. At the corners of the hall are four female figures, twelve feet in height, with arms extended, each supporting a large crystal chandelier.

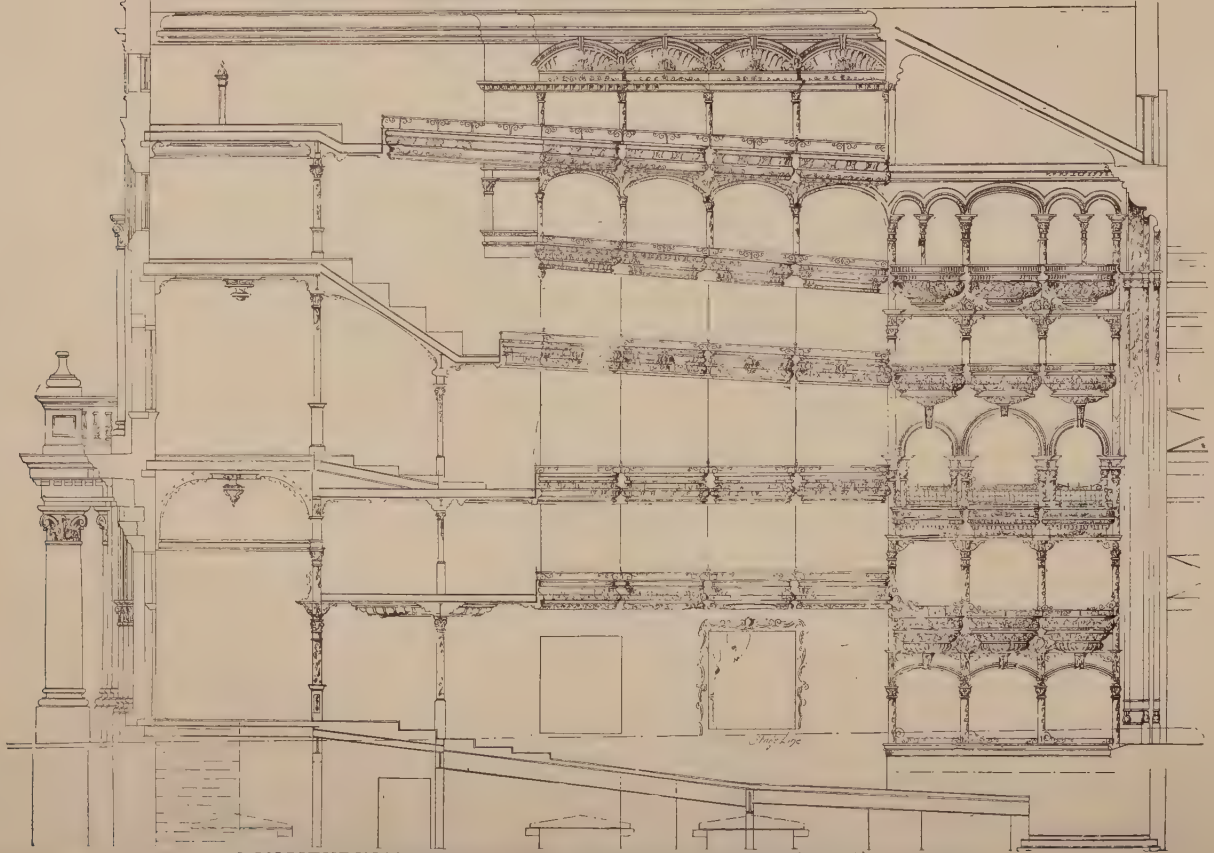
Four large mirrors are set in the sides between the pilasters, and the ceiling is elaborately decorated in floral designs.

The theatre is in white and gold, also elaborately decorated in floral designs and ornamented with statuary and relief figures representing the muse of the drama. The walls of the theatre are covered with ornamental designs in medallions and panels.

The base of the proscenium arch in the theatre, style Louis XVI., is modelled on a convexed surface, inclosed on the one hand by a rich old-gold leaf-moulding and bead, on the other by a flower-band standing out almost free, which run up on each side of the arch to a point in the middle of the top.

Motif composed of classic Louis Seize vase in bas-relief, in which kneels a cupid in perspective; a dove, drapery, and a liberal quantity of flowers finish the whole.

The music hall has a seating capacity of about 1625, in seats arranged as follows: first floor, 576 chairs, 16 boxes; first box-tier, 32 boxes, 160 people; second box-tier, 32 boxes, being similar to the first box-tier; balcony, 210 chairs, 40 boxes, 410 people; gallery, 165 chairs, 12 boxes, 225 people. In addition to the above there is 934 square feet of



LONGITUDINAL SECTION OF THEATRE, HAMMERSTEIN'S OLYMPIA.

standing-room. The steppings of the first-floor plan are arranged somewhat differently from those of any theatre heretofore illustrated, in that those in the centre, or parquette circle, are described from a point on the centre-line, 37 feet 6 inches from the curtain-line, while those right and left of the centre are described by a line extending from the same point 13 feet 8½ inches distant, 11 feet 4 inches back on the centre-line, and 7 feet 4 inches right and left of the centre-line.

The steppings of the parquette and circle are 3 feet 4 inches wide.

The seating capacity of the theatre is about 1000, in seats as follows: first floor, 371 chairs, 6 boxes, 401 people; first and second box-tiers, 22 boxes each, 110 people each; balcony, 106 chairs, 28 boxes, 248 people; gallery, 77 chairs, 8 boxes, 117 people. In addition there is about 900 square feet of standing-room. The steppings of the different tiers are about 2 feet 8 inches wide.

The stairways connecting the first and second balconies in both buildings are easy and about 6 feet 6 inches wide, placed as shown upon the plans, and are not included in the square feet of standing-room mentioned above.

There is no standard in this country by which the Olympia can be measured. No theatrical management ever before offered the public such a diversified scheme of amusement in such a building as this.

THE GAIETY THEATRE.

The evening of the 24th day of March, 1894, the Gaiety Theatre of Boston was opened for the inspection and admiration of over two thousand invited guests, and was formally opened to the public on the following Monday, March 26th. It was designed and constructed by J. B. McElfatrick & Son, architects. This palatial playhouse for "continuous performances" is splendidly located on Washington Street, Boston's principal thoroughfare, in the heart of the shopping district, and having as its nearest neighbors that famous hostelry the Adams House, which adjoins it on the south, and the Boston Theatre on the north side.

At each side of the loggia, or outermost portion of the grand entrance, is a circular ticket-office, composed of Sienna marble and plate glass, set off with ornate designs in silver and surmounted with a dome beautifully designed in stereo-relief, with decorations in ivory and gold. The floor of the loggia is inlaid mosaic in a small detached pattern, and the wainscoting, of Sienna marble rich in coloring, is broken on either side by mirrors of heroic size, reaching from the floor to the beautifully decorated ceiling.

At the right of this entrance is the "Bureau of Information," where may be found the telephone, messenger-call, writing-desks, with all appurtenances—directories, time-tables and guide-books, etc.

Heavy doors in ornate design in stained glass and stereo-relief work open in the lobby foyer, the prevailing tint of which is Nile green. On the right are conveniences for checking wraps, umbrellas, parcels, etc.; on the left is an ornamental fireplace, with marble mantle and large plate mirror, surmounted by an exquisite design in stereo-relief. Still

FRONT OF GAIETY THEATRE.

another set of doors leads to the main foyer, which is unquestionably the most magnificent apartment connected with any amusement palace. The walls are treated in rich old-rose, the surfaces of which are broken alternately at regular intervals by mirrors and superb panel paintings. The floor is of white marble tiling, and the same handsome, expensive marble wainscoting that distinguishes the before-mentioned approaches is used here. Here also, as in every other portion of the edifice, lavish use of electricity as an illuminating medium is strongly in evidence. There are over three hundred incandescent lamps in this apartment alone, the fixtures of which are of brass, with richly burnished gold finish, furnished from special designs of the Louis XV. order, conforming with the general decorative scheme of the house. On the left of this apartment are four business offices, and at the extreme end a marble staircase leads to the first balcony.

Another set of swinging doors of ornate design, covered with leather and resplendent with solid silver plates, admits to the orchestra reception-room.

At the right is a broad staircase leading to the balcony. A few steps beyond and one enters into a suite of three sumptuously furnished apartments reserved exclusively for the use of ladies, the central one of which is a cosey dressing-room, fitted with all the toilet conveniences.

To the left of this grand reception-hall is a lofty magnificently carved mantelpiece of finest oak, in the tiled fireplace of which burns a mammoth gas-log, and close by is an antique writing-desk holding stationery, writing materials, and stamps, for the convenience of the visitors. A flight of marble steps leads to the men's lavatories and the smoking-room, both of which are models of comfort and neatness, the latter being kept constantly supplied with all the leading daily papers.

Three immense archways form the entrance to the spacious

auditorium, the walls of which are in green and rose in brocaded silk effect. The wainscoting and the railing back of the orchestra is of cherry, the latter, as well as the private boxes and balcony-rails, being upholstered in soft green plush, and all, with the exception of the orchestra-rail, being surmounted with ornamental metal-work.

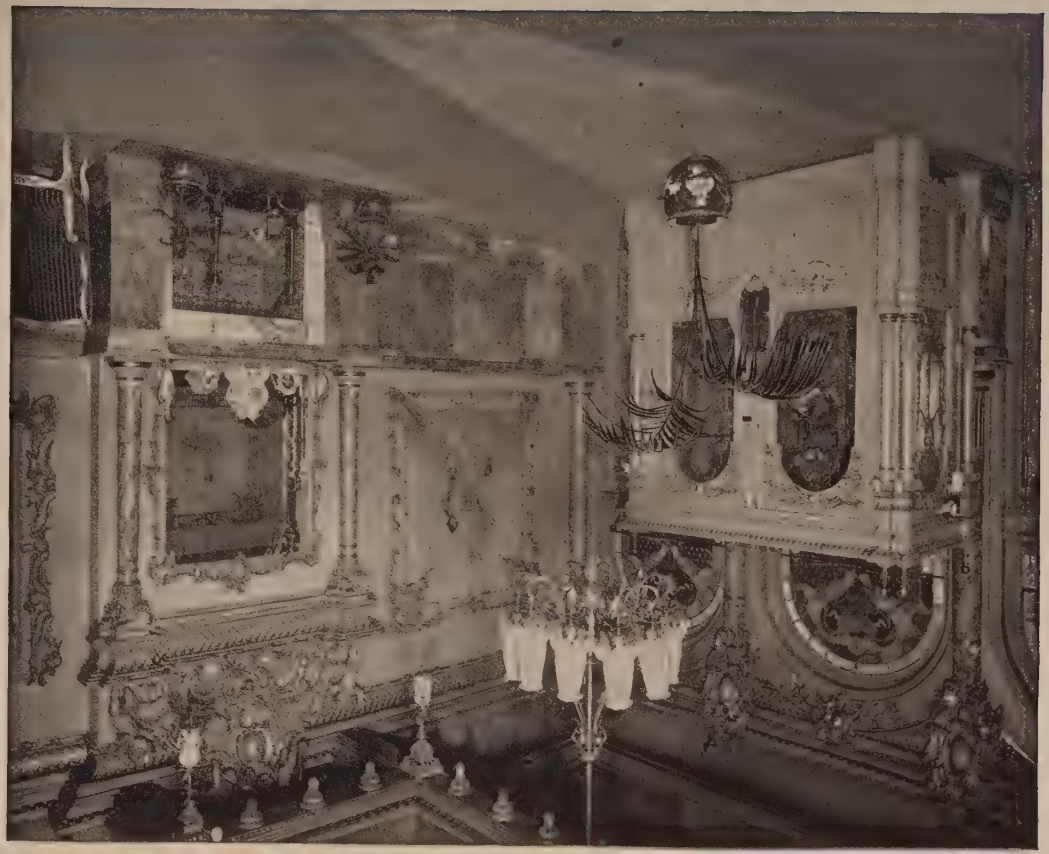
The floor is covered with an English Melton carpet, harmonizing in design and color with the prevailing tints of the walls.

The balcony is supported with nine ornamental iron pillars, and the ceiling is made attractive by exquisite designs in hand-painting and stereo-relief. The fronts of the first and second balconies are treated in white and gold, as are also the private boxes, of which there are twelve, six on either side, luxuriously furnished and artistically embellished in costly silks and lace designs.

Over the proscenium are three more magnificent paintings, heroic in size, the compositions being formed of draped female figures in a series of three panels. The centre one is emblematical of dancing, that to the right of comedy, and that to the left of music. The lofty ceiling is richly decorated and is made attractive by a unique electrolier, designed in the form of a system of intricate scrollwork in stereo-relief reaching nearly across the theatre, ornamented in gold and containing one hundred and eighty incandescent lamps.

The same lavish decoration that prevails in the orchestra section of the auditorium extends to the first balcony, in the rear of which is an apartment for ladies and the same toilet conveniences as on the first floor. Here, also, is a grand reception-room.

The exclusive features of this palatial playhouse are numerous. Although it is unquestionably as near fire-proof as human skill could make it, even the remote contingency of fire has been taken into consideration, and with such good



CORNER GRAND RECEPTION-ROOM, GAIETY THEATRE.

effect that it is estimated that the house, seating nearly three thousand people, could be emptied in three minutes.

The main floor-plan describes the general outlay of the structure. The auditorium is 77 feet wide, 80 feet 8 inches from curtain-line to back of parquette circle, and 47 feet 4 inches from stage floor-level to dome. There are three main entrance-doors from the foyer, 8 feet wide each, and three emergency exits, 6 feet wide each, leading to Gaiety Place. Those on the two upper tiers open upon wide iron fire-escapes of the most approved pattern, so that practically this side of the house could be thrown open at a moment's notice. There is also a public exit to Mason Street on the opposite side, and four exits from the stage which could be utilized in case of necessity, as well as the main exit to Washington Street.

In addition, almost every appliance for extinguishing fire known to science is at hand at all times, and the stage, besides being provided with a fire-proof curtain, could in ten seconds be drenched with a perfect torrent of water.

The stage is 60 feet wide, 42 feet deep, and 70 feet in height from the floor-level to the rigging-loft, the fly-galleries being arranged as shown on the section. The first fly-gallery is 8 feet, the second 18, and the third 28 feet, respectively, from the stage-level.

There are five dressing-rooms, a chorus and a property room upon the first floor, and ten other dressing-rooms arranged on the fly-gallery levels, each one having outside ventilation and being provided with marble wash-bowls, hot and cold water, and other conveniences necessary to the players. There are toilet-rooms fitted with all the latest improvements; and a feature which is a decided novelty is an elegantly appointed bathroom for the exclusive use of the performers. The stage itself is roomy and is fitted with all the modern appliances.

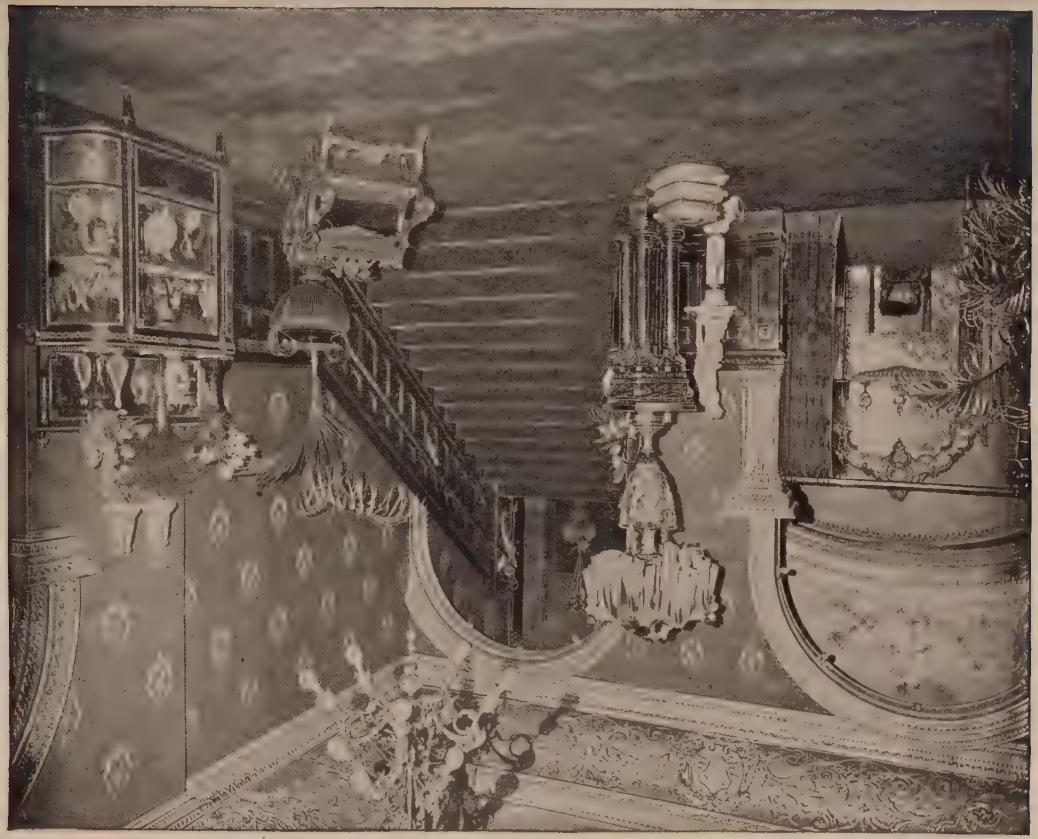
One of the most important features of the establishment is

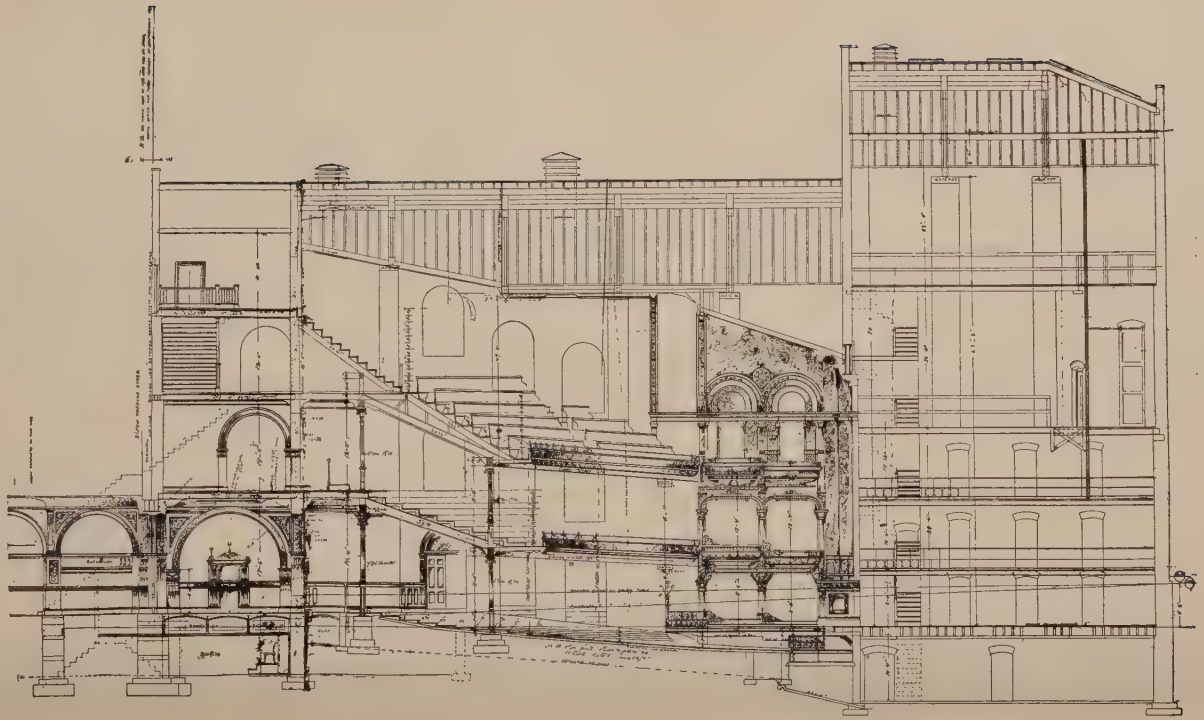
the system of electrical illumination, the magnitude of which can be better appreciated when it is known that there are in constant use in the various parts of the building nearly five thousand incandescent lamps and forty powerful arc lamps.

SEATING.

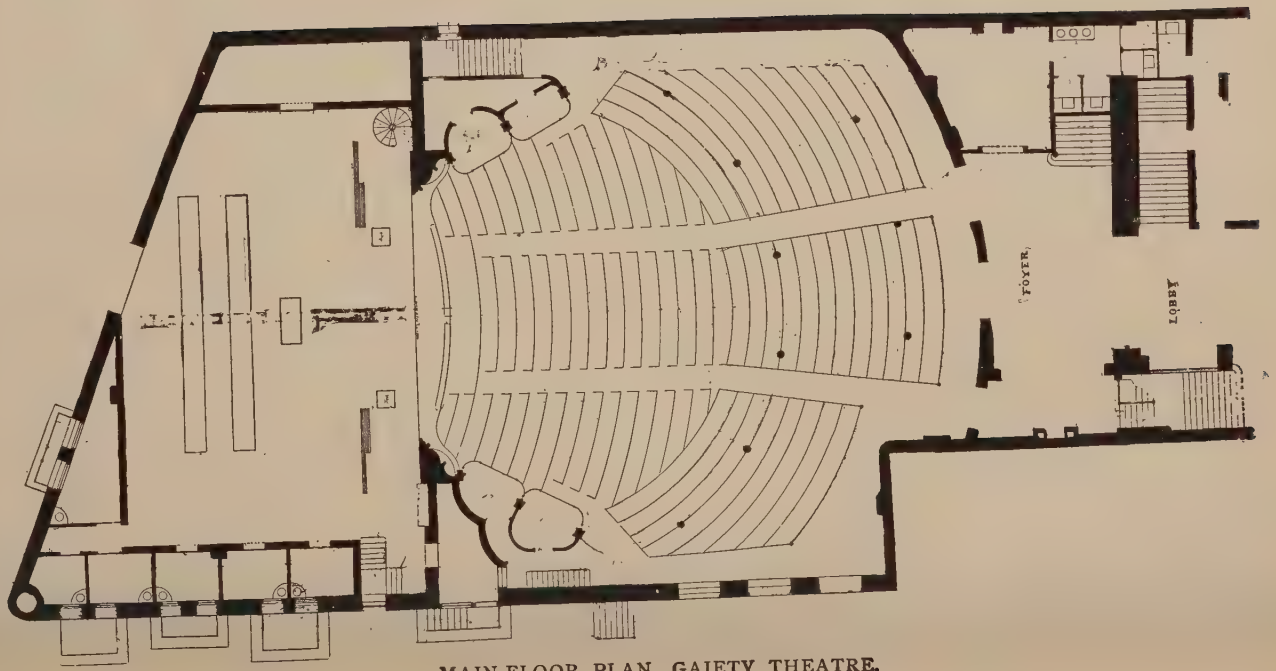
No one except those who have designed and constructed the galleries of a theatre are able to understand how difficult it is to place every seat in a position so that its occupant is able to see and hear with ease. In the Gaiety, as well as in the other theatres herein illustrated, the seats are arranged in a practical and artistic manner, and, last but not least, comfort for the occupants has been well considered. Every audience should be seated so that a feeling of comfort and relaxation is produced, and that the effects of an entertainment can be enjoyed at ease. Then, again, methods of ingress should avoid the uncomfortable disturbance of one half the audience to suit the other half. But as no immediate danger exists in seating an audience, their egress should receive the more carefully studied consideration, for it must give opportunity for sudden haste without creating a jam and confusion which ordinary discretion and precautionary measures can overcome.

The people realize the improvements which have been made in the last few years in the manner of seating theatres. From the plain, hard, wooden benches which formerly were used in places of this kind we have come to the luxuriously upholstered opera and assembly chairs and folding seats. For example, the automatic assembly chair, a chair having the following distinct features: the retreating or self-folding seat is operated at the will of the occupant; it folds into a minimum of space by slightly pressing the edge of the seat with the limbs in the natural act of rising; it is noiseless and does not require the strength of a Samson to fold the seat.





LONGITUDINAL SECTION, GAIETY THEATRE.



MAIN-FLOOR PLAN, GAIETY THEATRE.

Chairs are made 18, 19, 20, and 21 inches wide; that is, an 18-inch chair refers to the distance from centre of one arm to the centre of the next.

To prevent the irregularities in the aisles, different widths of chairs are used, which difference is not noticeable when the chairs are set up in a row.

The chairs are so nearly put together before leaving the factory that any mechanic can complete the work at the building, especially when full printed directions are furnished by the makers.

The distance allowed in setting chairs back to back is 29 to 31 inches; automatic tilting backs, from 25 to 30 inches.

The average weight, upholstered, is from 30 to 35 pounds each; tilting-back veneer chairs, such as are commonly used in top galleries, from 25 to 30 pounds each.

One of the newest improvements in chairs is a double-seat sofa or divan, made in lengths of from 36 to 42 inches, measurements being taken from the centre of one arm to the centre of the next.

Another improvement is made in the seats of the improved chairs; a twisted wire spring is used in place of the spiral, so that very little stuffing is required on top; the seat having no chance to pack down, allows full circulation of air and always remains sweet and clean. It also has an even bearing surface, the advantages of which are self-evident.

The writer remembers once using an automatic chair where the seat rose sideways, leaving the gangway the full width of the chair between adjacent standards.

A MARBLE ENGINE-ROOM.

The handsomest and most expensive engine-room in the way of appointments in this country to-day will be found in this theatre. It is a veritable marble palace, fitted up with

luxury, elegance, and artistic taste. Its beauty excites expressions of delight and wonder from the thousands who weekly visit the rooms and linger to enjoy them, regardless of the other attractions of the theatre. In fact, the highest compliment that can be paid to it is that it contains the best work of E. W. Maynard, who has a national reputation as a theatre architect, having designed, among other noted theatres of Boston, the Castle Square and the Tremont.

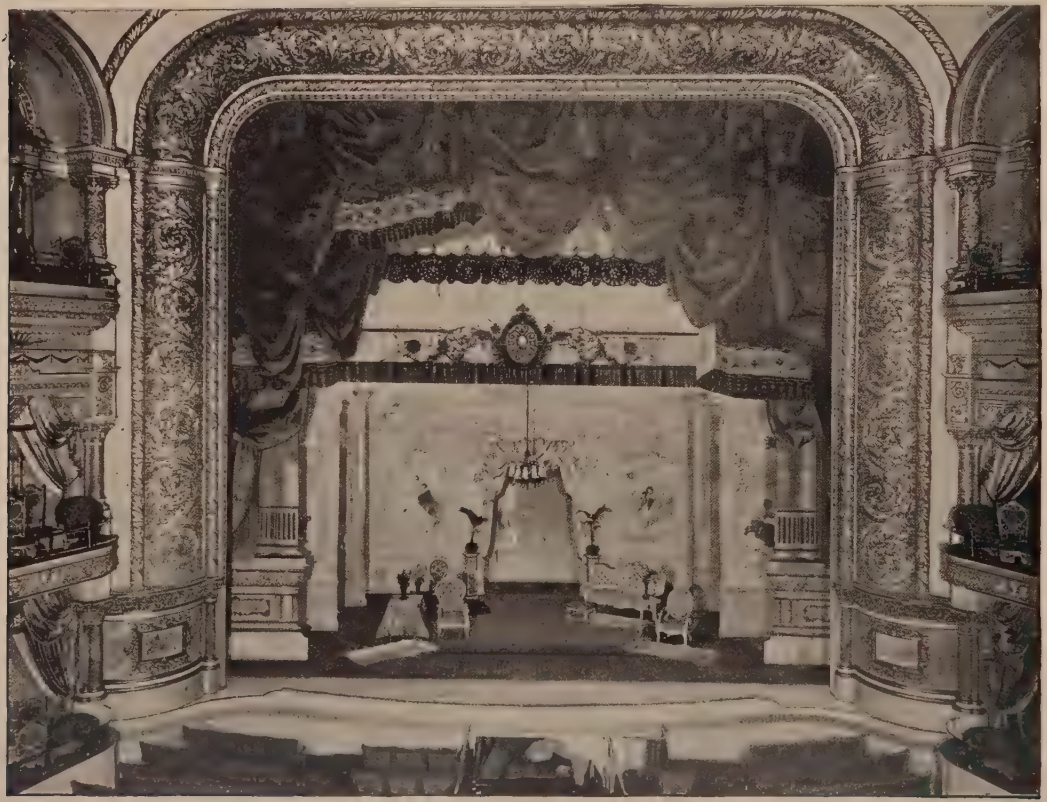
Starting from the main theatre entrance, we pass down a marble staircase and through a long corridor, for the engine-room is 32 feet below the street-level. The corridor has a marble floor and a panelled wainscoting of white, above which the walls are tinted in rose, shading from a deep color at the base to a very light, in fact almost cream, shade at the frieze which surmounts it.

Passing along this corridor we enter the reception-room, which is formed by an alcove 20 feet square, opening into the engine-room proper. The floor is of white marble, as also is the wainscoting to a height of 4 feet. Above the wainscoting the walls are shaded from a mild green to a light pink. The furnishings of this room are costly and elegant.

Electroliers, covered by opalescent globes, throw a soft light about the room, heightening its beauty.

The whole of one side of the reception-room is taken up by a white marble switchboard, consisting of three white marble slabs 10 by 4 feet.

Upon the board are mounted three 1000-ampere double-pole switches. These main switches feed the current from the large generators to large bussbars in the back of the board. These bussbars further connect, by smaller ones, to sixty-six 100-ampere single-throw double-pole switches. These are connected in the rear of the board to the same number of cut-outs, which are mounted on slate. These switches are all quick-break, and are constructed of copper



VIEW OF THE STAGE, GAIETY THEATRE

PROSCENIUM ARCH, GAIETY THEATRE.

DECORATIONS BY TOJETTI.

and phosphor-bronze, nickel-plated and highly polished. The handles are made of highly-polished hard rubber, having the appearance of ebony.

At the top of the board are mounted sixty-six so-called pilot-lamps. These are so arranged as to form a double scroll, giving a most artistic appearance. There are also three Weston illuminated-dial ampere-meters, having a capacity of 1000 amperes each, a three-way switch, and an illuminated-dial volt-meter, by which the potential of either dynamo can be measured.

The stage switchboard is 6 by 7 feet, mounted on the wall.

On this board are thirty-four 50-ampere double-pole switches, and also twenty-seven regulators to control the stage and auditorium lights. The construction and combination of the switches is such that, by main levers and couplings connecting indicator-switches, all switches can be thrown at one operation, and also closed, thereby producing instantaneous darkness in the house, or gradual changes from red illumination to blue or white on the stage.

Passing from the alcove reception-room we enter the engine-room proper on a gallery extending entirely around it, on the same level as the room we have left. The floors, like the reception-room, are of white marble and tinted in the same manner. Surrounding the engines is a large nickel-plated railing, along which are placed at intervals newels supporting hammered brass electroliers.

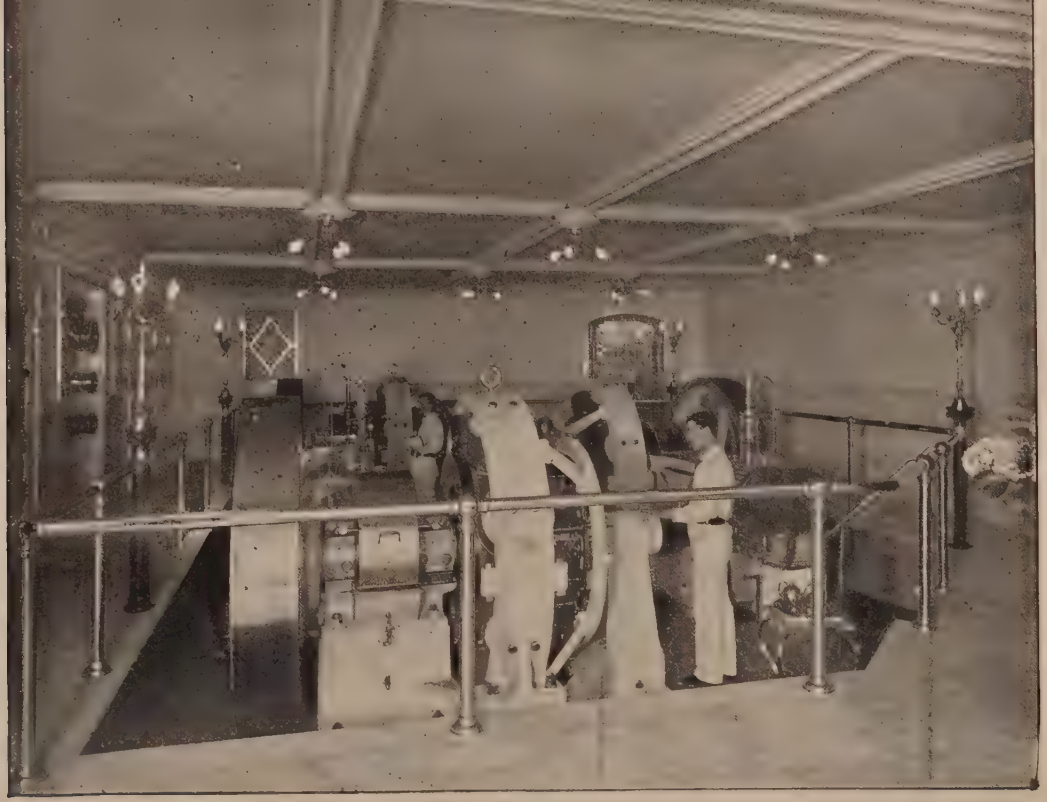
There are three engines and generators, direct-connected; that is, without any belting. The cylinders of engines being $15\frac{1}{2}$ inches in diameter, 14 inches stroke, and the generator of 100 K. W. capacity. The engines, without the dynamos, weigh 10 tons each; the floor-space for each being over 80 square feet.

The mechanical work throughout this entire plant for the

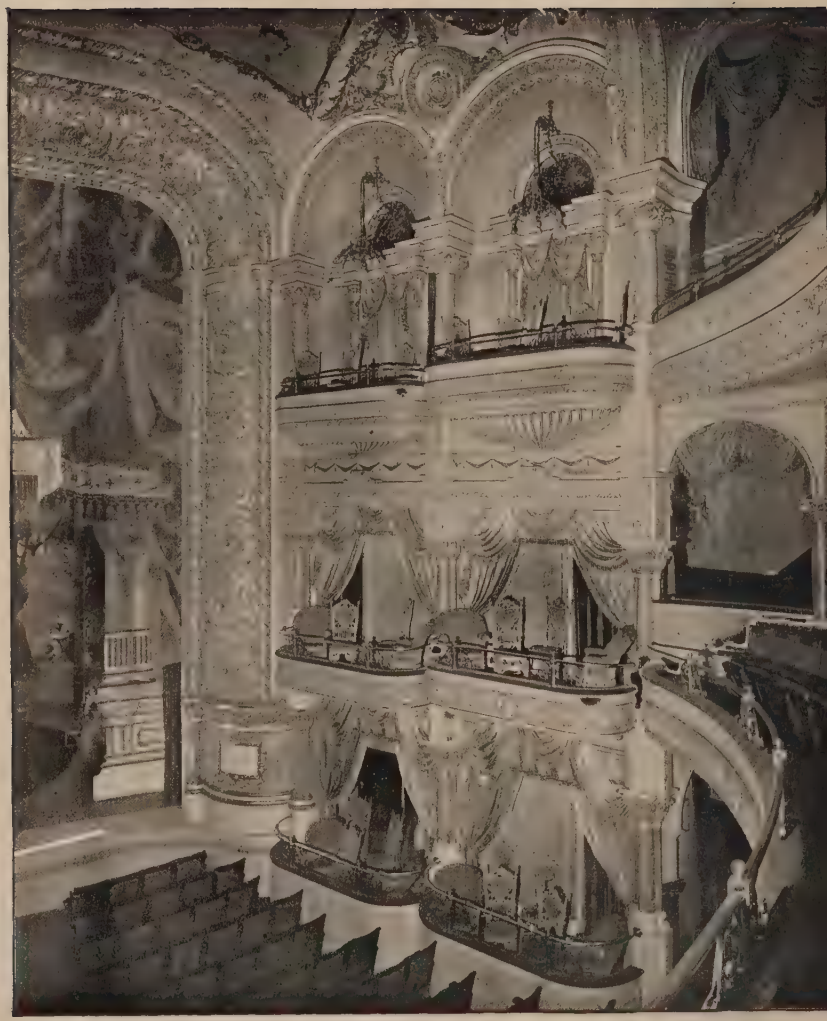
building is perfect. There is nothing unsightly or painful to the mechanical eye—no nickel-plated work except the lubricators and trimmings, but everything is metal finish, and shows not only the amount of labor but also care and attention. In fact, for elegance, utility, beauty, and artistic worth, the two rooms, with their furnishings, surpass any of their kind known.

Shorn of the technicalities which would be confusing to the average reader, the above is a description of the machinery and the interesting spot in which it is located. It is a wonder-shop of marble and swiftly moving steel 32 feet underground, as heretofore mentioned, and in proximity to a battery of boilers, but so well ventilated that presence in it is a pleasure. The absolute cleanliness which pervades every nook and corner of the building is a matter of comment, and, although thousands of people cross the threshold daily, that same bright, fresh, and wholesome appearance so noticeable at the opening is still apparent.

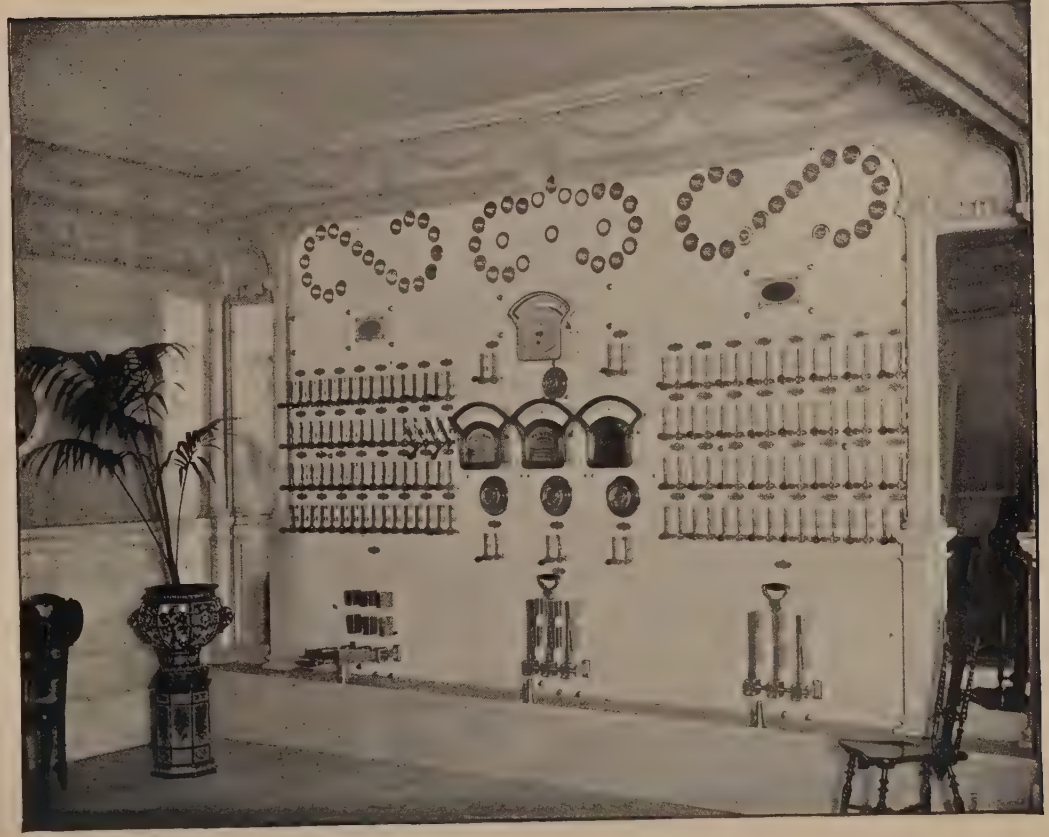
As may well be imagined, this condition of affairs is only maintained by the exercise of the utmost vigilance and the carrying out of a carefully arranged system of routine work. There are 115 attachés connected with the theatre; and as fully one half the number are employed for the express purpose of keeping up the high standard of neatness, it will be seen that the impossibility of the accumulation of dirt is apparent.



SECTION OF DYNAMO- AND ENGINE-ROOM, GAIETY THEATRE.



SECTION PROSCENIUM AND PRIVATE BOXES, GAIETY THEATRE.



SWITCHBOARD, GAIETY THEATRE.

THE ABBEY THEATRE.

The Abbey Theatre, corner of Broadway and Thirty-eighth Street, the newest of the places of amusement for which New York is noted, combines in its planning and decorations all the comforts and beauties required by the theatre-going public.

The seating capacity is 1450.

The work of demolishing the old buildings upon which the new structure stands was commenced May 1, 1893; in the short space of 6 months and 8 days the new theatre was opened by Henry Irving and Ellen Terry in Lord Tennyson's play *Becket*.

This theatre is one of the first to be completed since the enactment of the new law relating to the building of theatres. The law is stricter than any of its predecessors, and in the case of the Abbey Theatre has been rigidly enforced. The exterior of the theatre presents a six-story office building of light stone.

A new feature in regard to the exits has been introduced. All the doors are controlled by electric openers; by pressing a button on the stage, or from either of two stations on each tier, in the manager's office or box-office, all the doors will fly open.

It is calculated that a large audience can get out of the theatre in a minute and a half by using the various exits.

To prevent fire that might arise on the stage from extending into the auditorium the *asbestos* curtain demanded by law has been provided, and as a further precaution two large windows or skylights have been placed on the roof over the stage, and so built that when not pressed down they will fly open.

A light rope has been attached to each and carried down to the stage. By applying a match or using a penknife these ropes are loosened, whereupon the windows will fly open. In case of fire upon the stage—the asbestos curtain being down—the draught would all be directly through the windows, and it would be impossible for the flames to go in any other direction than upward. Every precaution has been taken to guard against fire, and the entire building is as nearly fire-proof as possible. The heating is by an indirect-blower apparatus, and the lighting is by electricity furnished by a special plant under the sidewalk.

The lights can be absolutely controlled, and can be raised or lowered as perfectly as gas. The wires are insulated, and carried through the building in brass tubes.

For a modern theatre a suitable site is the most important. If on the inside lots of a city block between streets, 10 to 12 feet should separate a theatre from contiguous buildings. The corner site is to be preferred. To successfully design a plan, a general knowledge of the internal workings of such buildings must be first acquired. The representative of each department should be consulted.

The plans should be such that masonry walls separate the auditorium, entrances, staircases, stage workshops, and dressing-rooms, and when practicable these walls should be carried up through the roof. In the case of the proscenium wall this is imperative.

Construct all roofs as flat as possible, connected with flights of iron platforms and stairways. The most approved plan should be lighted by means of windows in every part.

The auditorium, stage, and dressing-rooms should be sufficiently lighted from the outer air to conduce to ventilation and cleanliness.

Entrances and exits are all-important.

The safety of an audience depends more upon judiciously

ABBEY'S THEATRE, THIRTY-EIGHTH STREET AND BROADWAY, N. Y.

arranged means of egress than upon any precautionary system of fire-appliances or fire-resisting construction.

Panic may develop itself at any moment without adequate cause; consequently there should be means of escape from the building sufficient to withstand the sudden and extraordinary pressure of a stampede without the exits becoming congested. With this in view it seems that the present New York Building Law has been well considered.

Next to making proper provision for the audience the stage and its appurtenances should be made as fire-proof as possible. If it were possible to construct all the scenery and its workings of iron, we would have our present theatres as near perfection as it is possible to make them.

To provide a system of fire-proofing for the stage a new substance called the "Martin Process"—a paint containing salts and a pure zinc-white properly ground in oil—is frequently applied. It is a discovery of the French chemist Prof. Abel Jean Martin of Paris, and secured by letters patent in the United States. We are informed that the French Government has adopted the use of the Martin process, and its use has been made compulsory in all theatres, opera houses, and public places of amusement in France.

Prof. L. M. Norton of the Massachusetts Institute of Technology made some experiments of the above process, and from his report we find that three-quarter-inch kiln-dried pine was used in every experiment. He applied three coats of the solution; after drying thoroughly, he tested the board, and was unable to ignite it by a burner until the outer part was thoroughly carbonized. Treated with naphtha and set on fire, the naphtha burned completely away without setting the board on fire.

Prof. R. Ogden Doremus also made a few experiments, and found that after liquid No. 1 was applied to lace curtains, calicoes, muslins, and mosquito netting of different colors, the

goods retained their characteristic properties and colors. When dried they were not inflammable. Various papers, plain, printed, and engraved, also written documents, were immersed in solution No. 2 without altering their appearance; when dried they were not inflammable.

Pieces of wood were soaked with liquid No. 3; others were placed in the liquid, and the air in the pores of the wood was removed by means of an air-pump; the pressure of the atmosphere was then restored, thus forcing the saline solution to impregnate the wood more thoroughly. The specimens were then dried, when the wood was found to be almost incombustible.

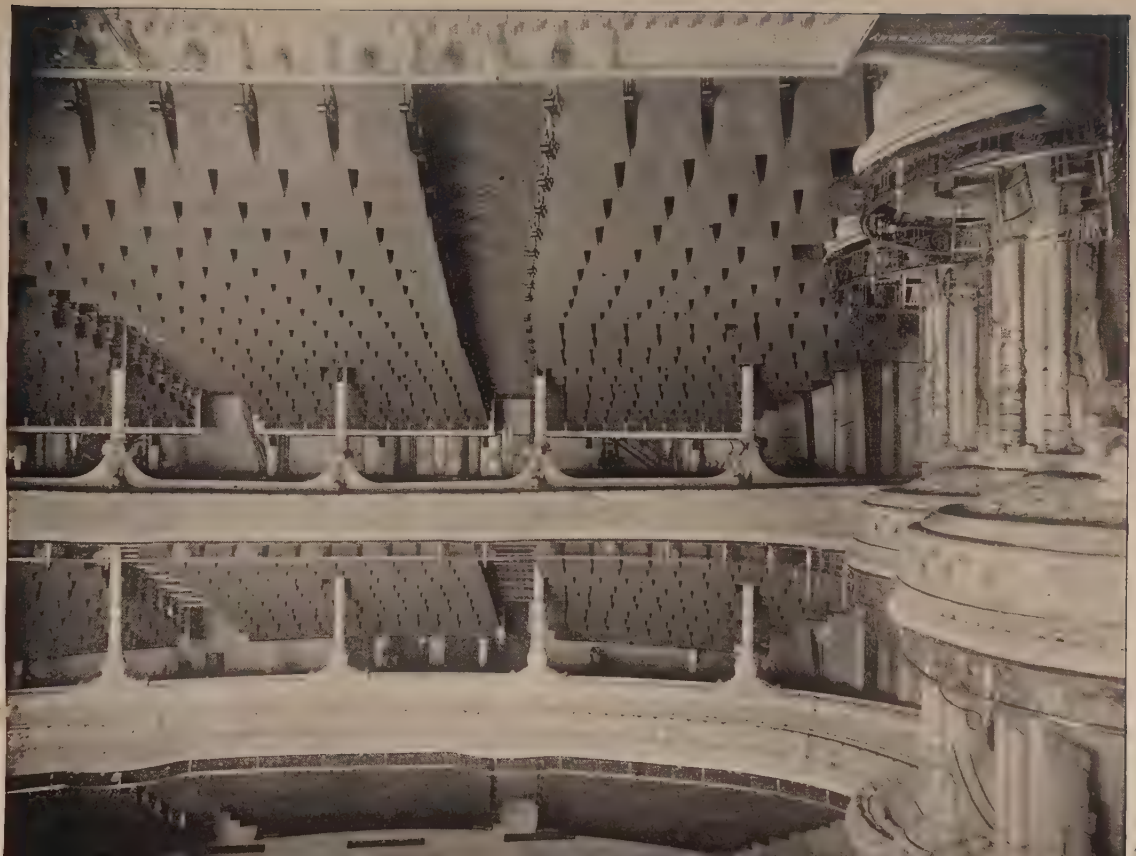
It does not come within the scope of this volume to enter upon a disquisition as to the style of architecture or decoration suitable for theatres, but one matter calling for improvement is the "act-drop," or substitute for a curtain. When these curtains are drawn up, the actors are discovered legs first and decapitated at the first descent. Neither landscapes, men, nor animals are admissible for purposes of decoration.

For the gradual, pleasing, and artistic development of the stage picture "tableau curtains" add considerably to the effectiveness of the interior, when made with rich material, harmonizing in color with the auditorium decorations.

PARQUETTE AND PARQUETTE-CIRCLE.

While managers regard the lower floor the "backbone" of the theatre, it is not consistent with public comfort that the seats in the circle should recede to any great extent under the overhanging balcony. Those occupying these back seats are subjected to inconveniences not experienced by the occupants of those in any other part of the house.

The usual method of planning the lower floor is to extend the parquette from the orchestra to the rail-line of the balcony above, on an upward pitch of about 10 to 15 inches at the



centre, and pitching toward the sides from the orchestra one half the same number of inches.

This inclination should take up about one half the lower floor from orchestra-rail to the rear of the parquette, then the stepping of the circle the other half.

If these steppings are excessive, the upper tiers will have to be correspondingly raised, for otherwise the occupants of the back seats would have their view of the stage considerably curtailed by the soffit of the tier above.

It should be possible for those standing at the extreme limit to see a height of not less than 16 feet at the curtain-line, although 12 feet is sometimes allowable.

For dramatic purposes the orchestra-pit may be partly, if not entirely, under the stage. For opera, burlesque, and musical plays it is necessary to place it within the auditorium, slightly below the parquette floor-level.

The orchestra of the Madison Square Theatre is placed upon a platform directly above the stage and upon the stage side of the curtain—a peculiar arrangement which, so far as we are aware, is unique.

The revised New York Building Law expressly provides against this mode of construction, in that, "If above the stage, it shall be placed upon the auditorium side." This will, no doubt, prevent its being attempted in this city in the future.

To fittingly describe the planning of the various floors, examples have been taken from the very best existing theatres; and by referring to the various plans in this chapter we are enabled to arrive at a much clearer idea of the subject. The Empire Theatre, Fortieth Street and Broadway, New York, and others will also be referred to. The Empire proper is 100 feet square and seats 1050 persons. It is in the style of the First Empire. The top story on Broadway is of terra cotta, the next lower of pressed Roman brick, and the two

lower stories of Indiana limestone. The auditorium is frescoed in crimson and gold and lighted by clusters of electric lights.

The interior is rich, quiet, and restful. All calculations for measurements, etc., will be taken from the curtain-line or back line of the proscenium opening.

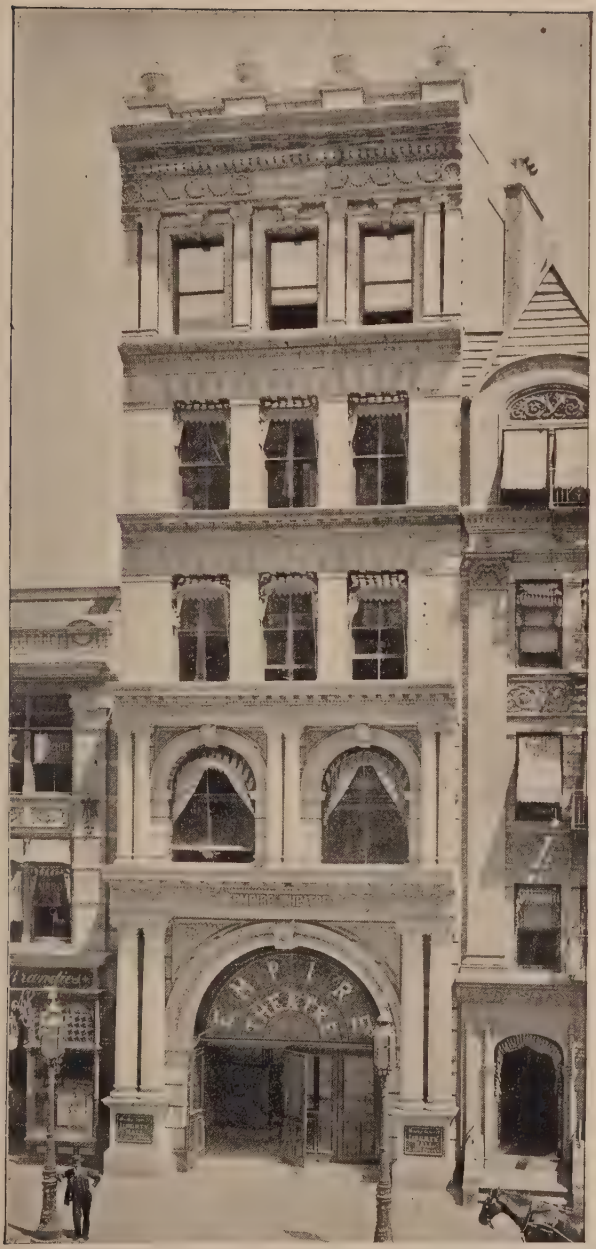
In the Empire this opening is 34 feet wide by 34 feet high, and about one half the width of the auditorium. The outer line of the footlights from the curtain-line is 5 feet, and is drawn from a point upon the centre-line of opening, extending backward 53 feet. From the same point a radius of 58 feet describes the orchestra-rail, then 2 feet 8 inches for the first row of seats, and continuing 2 feet 7 inches each for the remaining seats of the parquette.

The parquette circle, it will be seen by referring to the plan, is arranged in steps, which are described by a line drawn through the same centre from a point 4 feet from the curtain.

There is a gradual ascent given to the floor of the parquette at its centre, from the orchestra to the circle, of about 16½ inches; and from its centre to the sides of the auditorium at the widest part the same height is adopted. By referring to the longitudinal section it will be seen that the first stepping is 3 inches, then 3½ inches for the second, and continually increasing by half an inch for each successive step.

An additional row of seats is placed upon a raised platform at the back and above the foyer-level, as shown—omitted at the aisles.

The foyer-level, or the level of vestibule-entrance, is 6 inches above the stage. The auditorium is 66 feet in depth from the curtain-line and 69 feet wide, from which four aisles have been deducted, and about 8 feet from the depth for a promenade and stairway to balcony. The aisles are 3 feet wide nearest the orchestra, increasing to 4 feet at the circle-railing. An additional passage is also deducted from the



EMPIRE THEATRE, BROADWAY, NEAR FORTIETH STREET.
J. B. McElfatrick & Son, Architects.

width to give entrance to the boxes and their stairways. It will be seen at once that there is very little, if any, space but what is actually required for seating, ingress and egress.

Before and after the regular performance the main or Broadway entrance is used entirely for the lower floor and balcony. In case of fire, or for any other cause, there are provided four exits, two upon the right of the auditorium, leading to an open court, and two upon the left, leading to Fortieth Street through the ladies' parlor.

The entrance to the open court is also upon Fortieth Street, reached through a brick passage or tunnel under the foyer and entirely fire-proof. This subway or passage is not a desirable exit, but under the circumstances it was the best, no doubt, that could have been done, unless it were possible to procure passage to Broadway. In the first stage of a fire or panic it will answer its purpose, but when the constructive work of the interior is being consumed, falling beams, girders, etc., will no doubt crush the roof of any subway unless protected by a special heavily constructed frame.

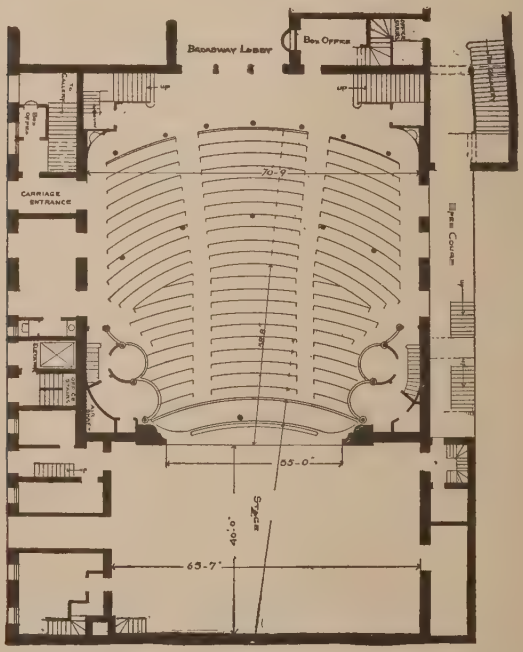
The New York Building Law requires at least one street-front, and for an emergency an open court or space on the side not bordering on the street when the theatre is situated upon the corner, and courts upon each side when the building is in the interior of a block or inside lots.

The sizes of courts are determined by the seating capacity; for instance, for a theatre seating 1000 persons a court 7 feet in width will be required; above 1000 and not over 1800, 8 feet; and above 1800, 10 feet. The courts are to begin at the proscenium wall, as shown upon the plan, and extend the length of the auditorium, with a separate and distinct corridor extending to the street from each open court.

The law also requires that there shall not be less than two exits on each side in each tier from and including the parquette and each and every gallery, and each exit to be not less than

5 feet in width. The Empire has an exit from stage to open court, two doors from parquette, and stairs from the upper tiers. There are also two entrances from the street to stage, and three from parquette to street, also the main entrance, 21 feet 4 inches wide, to Broadway.

By referring again to the longitudinal section the exact



PARQUETTE AND PARQUETTE CIRCLE, ABBEY'S THEATRE.

heights of the various tiers are shown. The balcony is 16 feet 6 inches above the foyer, the gallery 17 feet 11 inches above the balcony, and the roof 18 feet above the gallery. The height of the proscenium girder and opening is also shown, together with the fly-galleries, etc. The construction of the tiers is fully explained in detail, to follow. The Empire seats about 1150 persons.

In the Abbey Theatre, Broadway and Thirty-eighth Street, the parquette and circle are arranged upon the same general plan as the Empire, with some slight differences. By referring to the plan it will be seen that the proscenium opening is 35 feet wide and 34 feet in height. The auditorium is 79 feet in depth from curtain-line by 70 feet 9 inches in width, from which has been deducted 10 feet in the depth for the promenade and stairs to balcony, and in the width for aisles.

There are in this theatre three exits on the left of the auditorium, opening into the open court which leads to Broadway, and upon the right side three, two of which are to be used in case of emergency—through the ladies' parlor—the other as an entrance for those persons arriving and departing in carriages. The stage of the Abbey Theatre is 40 feet by 65 feet 7 inches, and the Empire 30 feet by 67 feet.

By referring to the longitudinal section the proper proportions of the Abbey Theatre are shown.

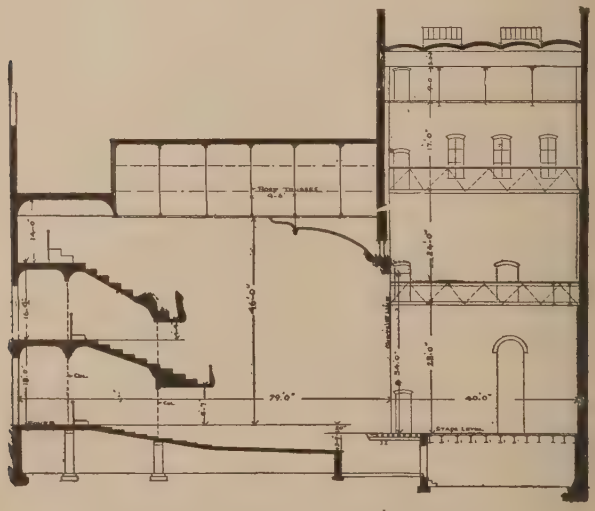
All measurements of heights are taken from the stage-level, the longitudinal measurements from the curtain-line. The parquette floor is 3 feet 9 inches below the stage and starts 10 feet from the curtain line. For a distance of 38 feet 8 inches there is an upward pitch of 12½ inches to the first stepping of the parquette circle, which step is 3 inches.

The other steppings are in the following order: the second step 3½ inches, third 4 inches, fourth 4½ inches, and continue in successive half-inch increases until the next to the last of 7 inches, which is the foyer-level, 20 inches above the stage.

There is an additional step of 8 inches by 2 feet 7 inches wide raised above the foyer-level. All these steps except the last mentioned pitch down toward the sides of the auditorium 6 inches.

The parquette floor gradually rises toward the boxes at the orchestra to meet the lowest step at that point.

The height of the balcony floor above the foyer-level is 18 feet, the lowest step 8 feet 7 inches above the same point. The lower step of the balcony descends 20 inches from the centre toward the boxes; consequently, the top step being level, this 20 inches is divided among the various steps at the wall-line. (See the heights and widths of these steppings explained under "Balcony Construction.")



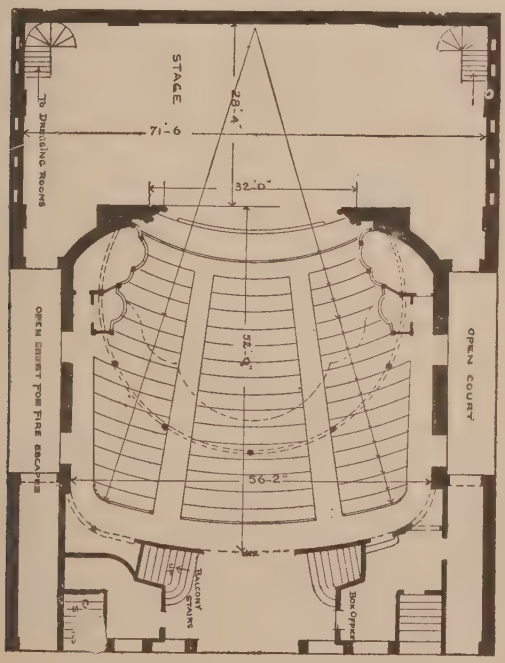
LONGITUDINAL SECTION, ABBEY'S THEATRE.

The gallery-floor, as shown by this section, is 16 feet 4 inches above the balcony, and 4 feet 4 inches at the lowest step. The upper step is level, and the first step descends 2 feet 10 inches toward the boxes; the difference of height is made up in the various number of steppings, as explained for the balcony.

The flat roof, 14 feet above the gallery, is constructed of steel beams and filled between with flat terra-cotta arches.

The hanging ceiling under the same is constructed of $1\frac{1}{2}'' \times 17_2 \times \frac{3}{16}''$ angles supported from the beams, curved at the intersection of the wall and truss, and covered with wire lath and plaster.

This section shows the bottom chords of the trusses sup-



PARQUETTE, HARRIGAN'S THEATRE.

porting the main roof of the auditorium, which are 47 feet 8 inches above the stage-level, and also clearly shows the north interior view of the stage. The large door upon the stage leads to the scene-room. The first set of flies is 28 feet above the stage, the second 52 feet, and the gridiron 69 feet. The paint-bridge is at the rear of the stage, connected to the first set of galleries.

The plan shows the general arrangement of the parquette floor of Harrigan's Theatre, Thirty-fifth Street, New York. Mr. Kimball, the architect, has upon three inside city lots planned and constructed a model theatre.

The auditorium is 52 feet in depth by 56 feet 2 inches wide, and the stage is 28 feet 4 inches deep by 71 feet 6 inches wide.

The front of stage, orchestra-line, and seating-lines have been described from a point at rear of stage upon the centre-line of proscenium opening.

The exits upon each side of the auditorium open into the courts as provided for in the New York Building Law, and open out into Thirty-fifth Street immediately adjoining the gallery-entrances.

The Manhattan Opera House is also erected upon inside city lots, between Thirty-fourth and Thirty-fifth streets, New York, planned and constructed by the architects who designed the Empire and Abbey theatres.

In this example the lower floor is divided into a parquette and parquette circle, from which two emergency exits are placed upon the right and three upon the left leading into the open court, then into the street at the front of the building on Thirty-fourth Street and the back at Thirty-fifth street. By referring to the section it will be seen that the parquette pitches gradually from the orchestra-rail to the first stepping of the circle, then these steppings increase by half an inch in height as they recede from the parquette.

The depth of the parquette floor at the orchestra-rail is governed by the stage-level, and is generally from 3 feet 6 inches to 4 feet 3 inches; 3 feet 9 inches being a medium height, it gives better results and fixes the eye of the spectator 5 inches above the stage-level.

In planning these theatres the architects have closely followed the building-law requirements. The moulded frame

in each around the proscenium brick opening is constructed of fire-proof material, and at the head or top of the opening there is a brick arch in addition to the large box-girders.

The girder is furred with iron and covered with the same material as the sides. The proscenium opening is also supplied with a fire-proof metal curtain, sliding at each end into iron grooves securely fastened to the brick walls.

The curtain is raised by approved machinery at the commencement of each performance, and lowered at the close.

The law requires all doorways or openings through the proscenium wall from the auditorium in every tier to have doors of iron or wood, and hung so as to be opened from either side at all times. The wooden doors are to be covered with sheet iron on both sides. No openings are allowed above the level of the auditorium ceiling. All aisles having seats on both sides are not less than three feet in width, and increase towards the exits in the ratio of $1\frac{1}{2}$ inches to 5 running feet.

The aggregate capacity of the foyer, lobbies, corridors, passages, and rooms, not including aisle-space, is sufficient, in the ratio of 150 superficial feet of floor-room, to accommodate 100 persons. Gradients or inclined planes are used in aisles when possible to overcome any slight difference in levels between aisles, corridors, and passages.

The law also requires the number of exits proportioned to the capacity of the house. For instance, for every theatre accommodating 500 at least three exits are required, and the width of each exit should be not less than 5 feet, and for every additional 100 persons or portion thereof in excess of 500 an aggregate of 20 inches additional exit width is demanded.

All doors are to open outward, and to swing in such a manner as not to become an obstruction in the passage or corridor, and should be unlocked during any performance.

DRESSING-ROOMS.

If the area of the site upon which the theatre is erected is not too small, it is unadvisable to restrict the number of dressing-rooms, and in most cases a number of small single rooms are to be preferred to a limited number of large ones.

If possible, the dressing-rooms should be separated by a corridor from the stage, and should have separate stairways for men and women. These stairways, although constructed of iron, should be arranged for quick and easy access to the stage, and at the same time be so cut off from it and the auditorium that the noise created by persons running up and down may not annoy the performers.

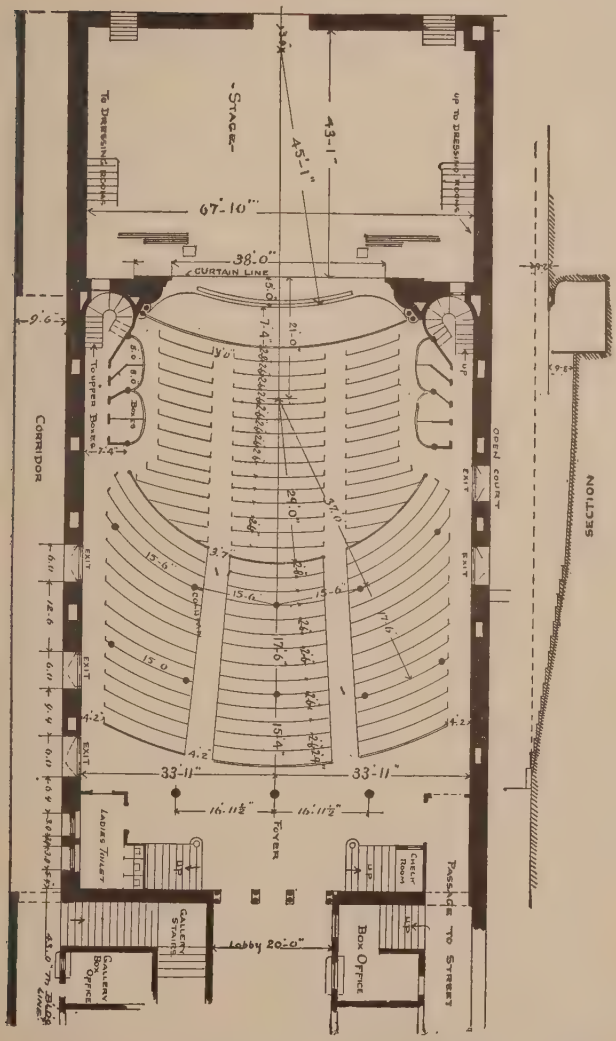
There should be two or more rooms for star performers, arranged as near the stage as practicable, with private lavatories and dressing accommodations.

In the Empire Theatre there are upon the stage-level three large rooms; upon the first fly-gallery level, one large and three small rooms. The other rooms are used as a carpenter-shop and scene-room. The Abbey Theatre has at least ten dressing-rooms, with a scene and a trunk room.

Larger theatres have their work-rooms, such as are used by carpenters, property-makers, modellers, blacksmith, gas-fitter, and scene-painter.

The carpenter-shop should be at the stage-floor level, and as the "battens" used for mounting the "cloths" will be stored here, the length of the shop should exceed by a few feet the width of the proscenium opening. The property-making room should be situated close to the carpenter-shop and separated by fire-proof doors. The modelling-room should adjoin the property-room as well as the smith-shop.

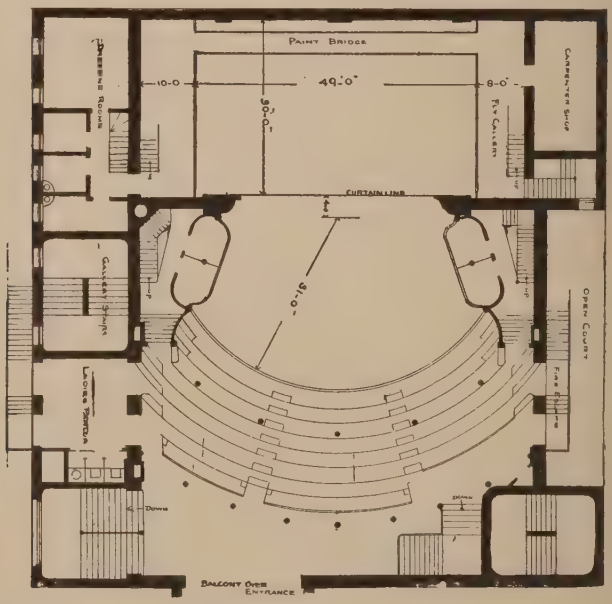
In most of the smaller theatres to-day the painting of the scenes is done from the "paint-bridge." The paint-frames are suspended from the "gridiron" and raised and lowered



PARQUETTE AND PARQUETTE CIRCLE, MANHATTAN OPERA HOUSE.

from the fly-galleries, but a separate room should be provided for storing colors, brushes, and other materials. A storeroom should also be provided to store furniture, arms, armor, and materials.

The walls separating the actors' dressing-rooms from the stage, and the partitions dividing the dressing-rooms, together



BALCONY PLAN, EMPIRE THEATRE.

with the partitions of every passageway from the same to the stage, and all other partitions on or about the stage, should be constructed of fire-proof blocks or other fire-proof material. All doors should be of iron or wood and iron.

BALCONY AND GALLERY.

In planning the balcony and gallery tiers in the auditorium of the theatre we are not confronted by any new conditions

than those met with in arranging the parquette and parquette circle, except their fronts, the shapes of which, if improperly described, may affect the spectators' view from the side seats.

In many cases the balcony fronts are constructed level and the steppings upon the sides are increased in height, which further assists the view without increasing the height of the tier.

In such modern theatres as are herein described the fronts of the circles are lowered gradually as they near the sides of the auditorium or the boxes.

By referring to the balcony plan of the Empire Theatre it will be seen that the front is directly above the parquette circle, an excellent arrangement, by which a good view of the stage is obtained from the rear of the parquette circle.

To arrange the steppings of this circle a radius of 31 feet is taken from the same 4 feet distant from the curtain-line as that for the parquette circle, and seven steppings, with an additional one placed above the balcony tier. are obtained.

The plan also clearly shows the arrangement of stairways and exits.

Upon the right there are two emergency exits leading to an iron fire-escape, then to the bottom of the open court, and to Fortieth Street, as explained heretofore. To the left there are also two exits which lead to another fire-escape and then to the sidewalk through the ladies' parlor.

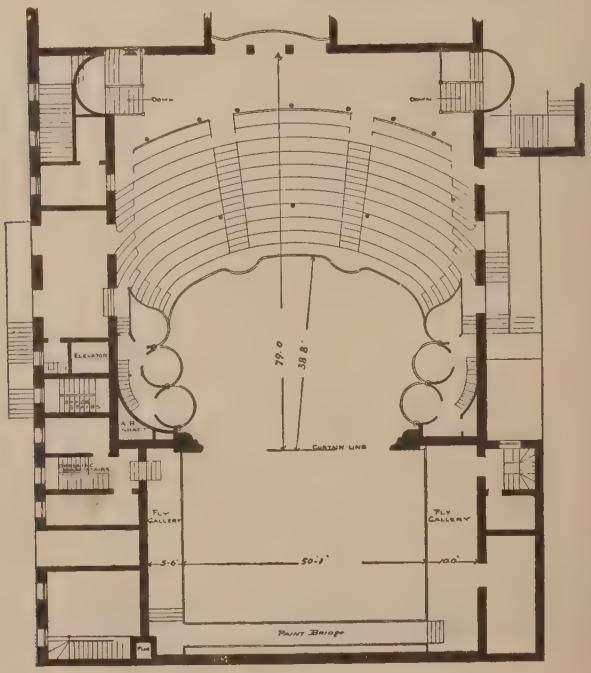
The main stairways of the balcony are placed at the back of the steppings as shown.

There are also stairways from the boxes on each side of the auditorium leading downward to the main floor and up to the gallery boxes.

Separate and distinct from this tier, and enclosed by solid brick walls, are shown the stairways of the gallery. The black dots upon the plan represent the position of the iron columns

supporting the gallery tier above, further shown and described in the constructive details of these floors.

In setting off the steppings upon the plan care should be taken that the exit-doors are placed in such a position that there may be no stumbling-blocks. The doors should not be



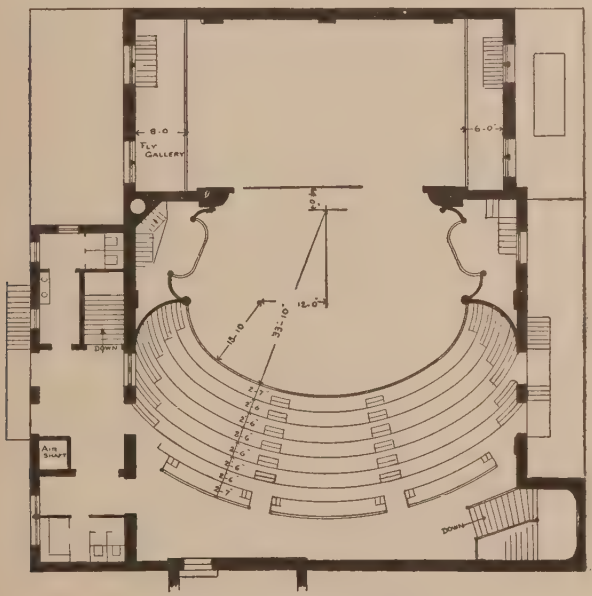
BALCONY PLAN, ABBEY'S THEATRE.

too near the lower steps, as in case of a stampede *the audience are more apt to stumble going downward than clambering upward*, and the doorways should not be too narrow and should always open outward.

The balcony plan of the Abbey Theatre is arranged somewhat similar to the balcony of the Empire. The first stepping is directly over the first step of the parquette circle below,

the dimensions of which are also fully explained in the sketch of the construction under Balcony Construction.

One-half of the front is drawn by a radius of 38 feet 8 inches at a point on the curtain-line, and all the steps are described from that point. That portion of the front rail is bowed outward about 12 inches directly in front of the aisles,



GALLERY, EMPIRE THEATRE.

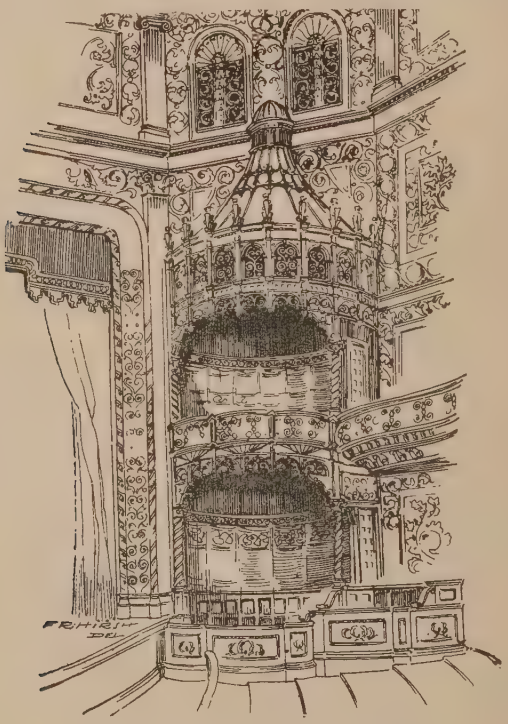
and from this point another radius of 10 feet is adopted to complete the circle, ending at the loggia box.

The arrangement of the staircases is also clearly shown upon this plan. The narrowest width of the foyer is 10 feet 4 inches, increasing toward the sides, at which points the two main stairways are arranged.

There are also, in addition to the above stairways, four emergency exits leading to fire-escapes, one placed in the

open court, the other outside the ladies' parlor upon the Thirty-eighth Street side of the theatre.

These fire-escapes, as well as those leading from the gallery exits, are arranged in such a manner that the audience do not



VIEW OF BOXES, THE GARRICK THEATRE.

intermingle when passing from each floor. The two boxes upon each side of this tier are circular and 8 feet diameter.

The gallery of the Empire is as well arranged as the balcony, with a slight difference in the shape of the circle front, and a greater pitch. The radius of the front is taken from the same point as that of the balcony, but another radius of 13 feet 10 inches, from a point directly opposite the last

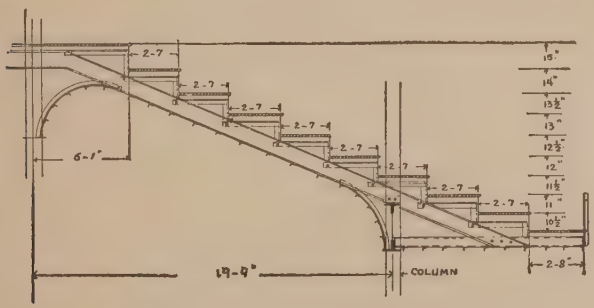
column of the boxes about 24 feet from the stage, is used to complete the circle.

This front is 2 feet 11 inches back of the balcony front, but has the same number of rows, the last two steps being constructed of wood above the tier-level.

Upon this floor, in addition to the regular stairways, there are also four emergency exits, two upon the right leading to the fire-escape of the court, and two upon the left leading to the Fortieth Street fire-escape. We wish to remark here that boxes placed upon the gallery tier of any theatre are not to be recommended, as it is impossible to see the stage without great inconvenience, and to see such boxes occupied at any performance is rare indeed. The appearance of the interior would be very much improved if this space were given over to a suitably finished top for the boxes below as shown by a sketch of boxes in the Garrick Theatre.

BALCONY CONSTRUCTION, ABBEY'S THEATRE.

The height of balcony from lower floor and gallery from balcony is given upon the longitudinal section, and the height of steppings is given upon the following section.



BALCONY CONSTRUCTION, ABBEY'S THEATRE.

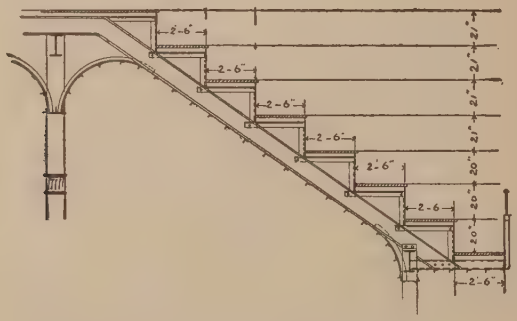
These steppings are not arranged upon the "isacoustic curve" system, but upon that in which the nosings are tan-

gent to a line drawn from a point on the curtain-line 4 feet to 4 feet 6 inches below the stage-level.

The first step is 10½ inches by 2 feet 8 inches wide, with the front of the circle bowed outward in front of the aisles.

The second step is 11 inches by 2 feet 7 inches wide, and each successive step increases by half an inch as the top level is reached; that is, the height of risers varies according to the distance of each circle from the stage.

As the steppings reach the side of the auditorium they increase in depth and each takes up its proportion of the 20 inches of rake.



GALLERY CONSTRUCTION, ABBEY'S THEATRE.

There has been much trouble caused by an improper laying out of steppings for galleries of this kind when they rake each side of the centre, and if not properly constructed a very decided hump is plainly visible in the centre. The steps should be quite level each side of the centre before the rake begins for a space of 2 to 2 feet 6 inches.

For the support of the steppings in this theatre there are 8-inch steel channels extending from a line of 12-inch beam-girders between the back columns to the inner-circle lattice-girders and projecting nearly 10 feet beyond the girder. These channels are placed about 2 feet 6 inches apart and

radiate toward the point from which the steppings are described.

The steps are constructed of 1-inch yellow-pine flooring upon 2-inch battens secured to stepping-pieces of $1\frac{1}{2}'' \times 1\frac{1}{2}''$ steel angles bolted to the radiating channels.

The risers are made of sheet iron about $\frac{1}{16}$ of an inch thick and also secured to the angles.

This section also shows the manner in which the furring and wire lathing are secured to form the coves and ceiling.

There are $1\frac{1}{4}'' \times 1\frac{1}{4}''$ angles bolted to the under side of the 8-inch channels and placed 16 inches apart. The coves are formed of bent $1\frac{1}{2}'' \times 1\frac{1}{2}''$ angles and secured as shown.

Upon the small $1\frac{1}{4}$-inch angles the wire lath is secured.

The front of the balcony, as well as the gallery, is constructed of 3-inch channel-posts placed about 4 feet apart and secured to a continuous 6-inch channel extending around the entire front.

The decorative plaster-work is secured to these upright posts and longitudinal channels with copper wire. To form the top rail of the front a 4-inch channel is used, to which is secured a wooden capping and brass railing.

The gallery of the Abbey is constructed similar to the balcony with the exception that the steppings are higher and narrower (see the detail).

The first step is 2 feet 6 inches wide by 20 inches high; the others follow each other in different order from those of the balcony, three of which are 20 inches and the remainder 21 inches high. This system decreases the height of the gallery tier to some extent, and has been found practicable. The aisles or gangways in both the balcony and gallery have been carefully proportioned.

The rule is to avoid excessive width, as it entails loss of seating, whilst if too narrow it creates a feeling of insufficiency.

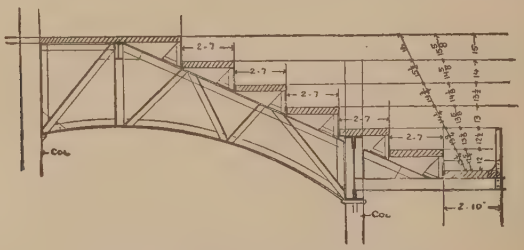
The number of seats in a row should never exceed ten, or at the greatest twelve, without an intervening aisle, and the minimum width of an aisle should be equal to two seats, or, as is generally laid out, 3 feet 6 inches to 4 feet at the back to 3 feet at the front.

The smaller steps of these aisles in the gallery should be as few as possible and easy, none over 8 inches in height.

The level floor of the parquette and parquette circle in this theatre is constructed with the ordinary method of steel beams supported upon small cast-iron columns and filled between with hollow fire-clay blocks.

BALCONY AND GALLERY CONSTRUCTION OF THE EMPIRE THEATRE.

In the Empire Theatre the balcony- and gallery-steppings are arranged similar to those of the Abbey; the widths are



BALCONY CONSTRUCTION, EMPIRE THEATRE.

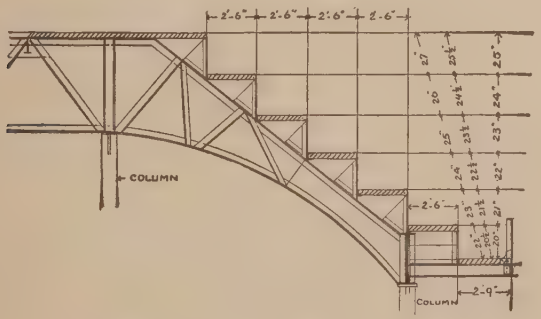
the same, but the heights of risers, on account of their nearness to the stage, are required to be increased.

The first step of the balcony is 12 inches in height and each step increases by half an inch as shown.

The vertical line of figures represents those at the centre: the first inclined line those at the first column from the centre; the second line those at the second column.

The gallery steps are designated in the same manner. The vertical line are those at the centre; 20 inches being the first step, then increasing by one inch each until the top is reached. To support the steppings small lattice-trusses are employed and placed about 8 feet apart, radiating from the point from which the steppings are described.

Between the trusses, and resting upon the bottom chords, Guastavino arches are constructed, making an excellent and practical system, doing away with all furring, and making desirable coves in the ceiling for decorations.



GALLERY CONSTUCTION, EMPIRE THEATRE.

To support the flooring (2-inch boarding in this case) knee-pieces of plates and angles are secured to the top chord of each truss as shown in the sketch. At the top of each knee-piece 2-inch channels and at the bottom 2-inch angles are secured, extending in a circle the entire length of the galleries.

The riser of $\frac{1}{4}$-inch plate iron is also secured to the face of these knees.

Another favorite method of constructing these galleries is to use steel beams; place them about 4 to 6 feet apart, according to their strength, and fill in between with fireproof arches of bricks or hollow tile.

This is no doubt the cheapest form, but the top and bottom of the beams are required to be bent to conform to the girders and steppings of the tiers. If the girders supporting the lower ends of these beams are level, the above is an easy task, but when the front rakes two or three feet the beams become different lengths; then different bends are required. This construction is also considerably heavier than the Guastavino arch system and requires more metal in the beams and columns.

In the Empire all the floors, galleries, and roof-work have been constructed with the Guastavino arch system.

The floor of the lower tier of boxes in the Abbey Theatre is 2 feet 3 inches below the stage-level, 10 feet 9 inches to the floor of the second tier, and 11 feet 3 inches to the top box.

The columns supporting each tier of boxes are of cast iron, 6 inches in diameter, with a box furring 12-inch square, composed of $1\frac{1}{4}'' \times 1\frac{1}{4}''$ corner angles, and covered with $\frac{3}{4}'' \times \frac{1}{4}''$ flat iron bars placed every 12 inches apart, to which the wire lath is secured.

As the boxes of the balcony and gallery are not entered from these tiers, they are not required to be on the same level, but may be connected by a few steps as shown upon the plans.

ACOUSTICS.

The theory of *acoustics* treats of phenomena difficult of practical application. Where absolute freedom in the choice of material is admissible, the difficulties are reduced, but even then it is questionable whether success can be guaranteed.

Buildings have been constructed on professed scientific principles, yet the result has been dire failure, while other buildings, erected with but little regard to scientific require-

ments, have, by a fortuitous combination of form and material, proved perfect models for the propagation of sound.

The safest method in deciding upon the shape of a theatre appears to be to adopt a form which is known to be in itself capable of conveying sound with facility, to construct it of materials which are of a conductive nature, and avoid all breaks and projections on the surface of such forms which tend to intercept or impede the progress of the sound when once conveyed to any part of it.

It is generally admitted that a circular enclosure, unobstructed by breaks and projections, possesses the power of conveying sound with facility, and that wood is the material which combines the greatest number of desirable qualities as to conduction, resonance, etc.

Wood does not absorb the sound so much as some materials, and does not conduct it so much as others.

That wood is sonorous and capable of producing soft, clear, and pleasing tones is sufficiently demonstrated by the effect of it in musical instruments.

There are few if any materials used in the ordinary methods of *fire-resisting* materials that will aid in the reinforcement of sound. But the danger attending the introduction of wood within the existing method of illumination is self-evident. It is therefore necessary to make the construction and finish fireproof. In fact there is little or no woodwork used in the construction of our present model theatres except that used for the working parts of the stage and the flooring upon which the seats are placed.

Considering that the requirements are such that the building be fireproof, we are still able to construct it so that the theatre shall combine all reasonable requirements for the propagation of sound and the economy of speech. With a view to obtain the best results there should be no projection or obstruction. The present method of constructing the

fronts of balconies, boxes, and galleries is to be recommended; the plastic decorations destroy the reflection of the sound-waves which usually occur if the surfaces are hard and smooth, as sound-waves impinging upon smooth and non-sonorous surfaces recoil and occasion confusion of sound by their intermingling. Where the ceiling of the auditorium and vertical walls join, there should be coves formed. The back walls of the boxes should be concave; the ceiling of balconies and galleries should be similarly constructed.

It may be accepted as a test of the acoustic properties of a building that these are defective when the speaker experiences difficulty in speaking, for then it is quite evident that some of his auditors are hearing with difficulty. Large air-spaces, whilst desirable for the purpose of ventilation, are prejudicial to acoustic effect, the sounds being dispersed and lost.

The auditorium ceiling should therefore be rather too low than too high, and all open space covered by screens, curtains, etc.

An English writer, referring to Her Majesty's Opera House, London, which was destroyed by fire some years ago, observed "that it was the very best theatre in the world for sound, and was certainly without any scientific principle of acoustics." In shape it was like a drum and the walls of the auditorium were flat. There were no projecting ornaments of any kind; the ceiling was perfectly smooth, without any ornamentation in relief, and the form is that of a slight dome.

Too much drapery in a theatre is undesirable,—it always deadens the sound,—but drapery may be hung in proper places to prevent reflection, especially upon the soffits of boxes when for practical reasons the rear partitions of the same are not properly coved.

The auditorium should therefore be constructed with some approach to this formation, the sides converging toward the proscenium, or, in other words, expanding toward the back

of the auditorium. The ceiling, as already pointed out, should follow the same principles of convergent lines and slope upward from its junction with the proscenium wall, and be coved at the side walls or with any partition within the auditorium. Such a ceiling, if without projecting ornamentation, will assist the conduction of sound toward the gallery.

It is probably unnecessary to say that a speaking-trumpet is the best form for conducting sound onward with undiminished force.

The primary necessity of acoustic perfection in a theatre is that the auditorium should not exceed in size the limits of the human voice when reasonably exerted. Given a good articulation, the voice may be heard in churches 60 to 70 feet in front, 40 to 45 feet on each side of, and 25 to 30 feet behind the preacher. This calculation comes near the carrying limit of the normal powers of the human voice, and the auditorium of a theatre will be within the natural direct radiation of sound when no person is farther than 75 feet from the speaker.

An authority found in his experiments that the natural expansion of the human voice, when moderately exerted, will be in the proportion of about two-ninths farther in a direct line than it will be laterally; and that, being distinctly audible on each side the speaker at a distance of 75 feet, it will be as plainly heard at a distance of at least 92 feet in front of the speaker, declining in strength behind him, so as not to be clearly heard at much more than 30 feet from his back. In actual practice it is frequently possible to hear the performers much better in the gallery of a theatre than in the lower portion of the house, which no doubt arises from the ascensional power of the atmosphere produced by increased temperature, and partly from the sound-waves failing to penetrate under the balcony or gallery.

Taking it for granted that the natural expansion of the

human voice is about 70 to 75 feet in a lateral direction on each side of the speaker, and as it is evident the space between the front-line of the stage, and the rear of the auditorium may at times constitute the lateral direction of the voice (refer to the plan Fig. 1), according as the actor's face shall be turned more or less toward either of the sides of the theatre, the utmost distance from the front of the stage to the rear ought not to exceed 75 feet, or the limit the voice is capable of expanding in a lateral direction. For if, calculating upon the actor's face being turned—as in general it would be—toward the front of the house, the distance between that part of the house and the most advanced line of the stage

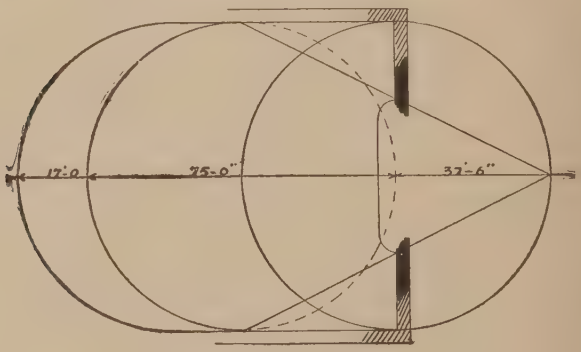


FIG. 1.—PLAN.

were to be considered as invariably the direct line of the voice, and were accordingly to be extended 92 feet—the expansion of the voice in a direct line—the consequence would be that upon a sudden turn of the actor's head what had before been the direct line of the sound would then become its lateral direction, and those persons sitting at a distance of 92 feet from the actor would be 17 feet beyond the reach of his voice.

The question might be asked here, Why not enlarge the

proscenium opening and open the full semicircle to the audience, omitting the boxes—which seldom, if ever, pay—and thus increase the seating capacity? But large proscenium openings are expensive; the stage does not require it for dramatic performances, and does not require such an outlay as would be required for costly scenery, borders, etc.—30 to 35 feet wide for the proscenium opening seems to be especially advantageous. Fig. 2 represents a vertical section of Fig. 1, or section through the centre-line of theatre, the

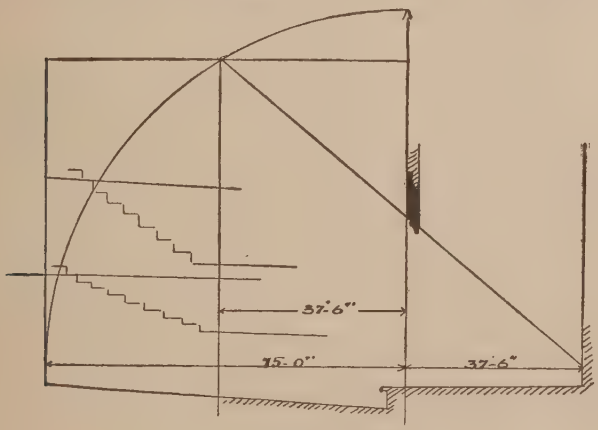


FIG. 2.—VERTICAL SECTION.

oblique line from back of stage to top of theatre corresponds to those upon the plan Fig. 1. These lines designate very nearly the proscenium opening.

Having stated that the extreme distance from the stage to the back row of seats facing the stage should be about 75 feet, we frequently find that in many theatres this distance varies more or less according to the seating capacity stated below. In a number of foreign theatres we perceive at once that the seating capacity is increased more or less as the extreme hearing distance is increased or decreased. If the

length is decreased, the width of the theatre is increased; then again in the case of some London theatres an additional tier is added to its height.

The theatre of San Carlos at Naples is 73 feet from curtain-line to back row of seats; the theatre at Bologne, 74 feet. Of the London theatres the Adelphi is 74 feet, seating capacity 2300; the Covent Garden Theatre 80 feet, seating capacity 3000; the Gaiety 53 feet 6 inches, seating capacity 1150; the Lancaster 58 feet 4 inches, seating capacity 1850; the Marlybone 75 feet, seating capacity 1400; the Globe Theatre 47 feet 6 inches, seating capacity 1100.

In an auditorium 70 to 75 feet from the curtain-line to the back of the parquette seats, by 70 to 75 feet wide, with balcony, gallery, and boxes adjoining the proscenium wall. It should be so arranged as to comfortably seat 1800 to 2000 persons. The ceiling of such an auditorium should be from 55 to 65 or even 70 feet high, measuring from the stage-level.

The architects of America are undoubtedly indebted to those of Great Britain for their knowledge of the planning of our model theatres. A number of remarks upon the subject of acoustics and sighting have been selected and quoted in these articles from British authors which have been found to especially refer to our existing buildings. We depend more upon what buildings have been successful in their acoustic and sighting properties than merely upon theoretical rules upon these subjects, and in our description of the plans of these buildings all their measurements and details are fully given.

SIGHTING.

Many failures in respect to sighting are largely attributed to the designer having failed to realize that the conditions contributing to perfection of sighting in a church or lecture-hall, where the speakers are stationary, are not compatible

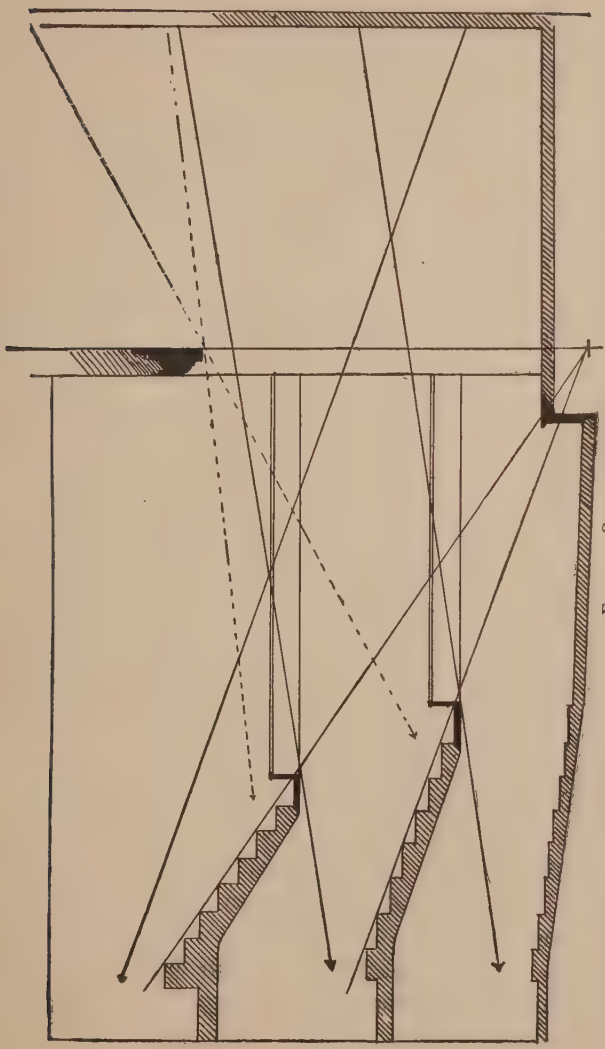


FIG. 3.—SIGHTING.

with the exigencies in a theatre, where the speakers are continually changing their position. In the former case the *sighting* is to one single point, while in the latter it must be equally good to a series of points extending along a line parallel with the spectator and some 30 to 40 feet long, according to the width of the proscenium opening.

When "setting up" the sections of the parquette circle, balcony, or gallery in the auditorium, it is desirable to sight from the eye-level of the spectator, which for practical purposes is 4 feet 2 inches from the floor when the spectator is seated, and 4 feet 10 inches to 5 feet when he is standing. The theoretical principle sometimes adopted when fixing the height of the steppings upon which the seats are placed is as follows: A point should be fixed on the curtain-line say 4 feet below the stage-level, and from this point—after the distance from the stage, the stepping, and floor-level is placed—set up the spectators' eyes 4 feet 2 inches above the floor vertical with the back rail of the seat. Now from the 4-feet point on the curtain-line a line should be drawn cutting through the eye of the spectator in the first row, and produced until it cuts a vertical line set up at the back of the second row. Then from the point where the vertical and radial lines intersect, if 6 inches is measured up, that point will give the eye-level of the second row. From the point below the stage a line drawn through the eye-level of the second row, and produced until it intersects the vertical line set up at the back of the third row, and from that point again measured up 6 inches for each row, and from each eye-level measured down 4 feet 2 inches will give the floor-level for each stepping.

When the heights of the stepping are obtained in the foregoing manner, the nosings are not tangent to a straight line, but to a concave curve, and the steppings are not equal in height, but become steeper as they recede from the stage. This curve has been named "*the isacoustic*" or equal-hearing

curve, and is a refinement seldom practised. By referring to the view from the stage of the Chicago Auditorium Building, Introduction, where this practice has been adopted, it will be plainly perceptible that with an auditorium of great depth (104 feet in this case) an advantage is gained by the above system. Advantage is taken of this rise of 17 feet to obtain under the higher parts of the parquette an entrance-foyer 80 by 118 feet, and a series of wardrobes and cloak-rooms of quite generous capacity. This unusually great rise of the main floor has also made practicable the arrangement of six entrances, similar to the "vomitoria" of the Roman amphitheatre, by which the lower half of the parquette seats are reached without rendering it necessary to climb to the upper level of the main floor. Excessive crowding upon the main stairs is also avoided.

The seats are also arranged in the first balcony in the same manner, which here develops a rise of about 40 feet from the lowest to the highest seats. Advantage has been taken of this to form two foyers, of which the lower one is 40 and the upper one 20 feet wide.

The foregoing arrangement possesses undoubted acoustic advantages, but in so far that it necessitates an excessive rake in the floor it has not been universally adopted, and can only be used succesfully in large auditoriums for operas, etc., but for small theatres, of which this book treats, a considerable modification of this system must be adopted.

The rake given to the parquette in the Chicago Auditorium is more than the exigencies of a reasonably good view of the stage demand. The several tiers are consequently elevated and the gallery raised a considerable distance above the level of the auditorium ceiling.

The most usual method adopted to find the rake of the seating is as follows: Having settled upon the position of the first row of the parquette circle, balcony, or gallery, a line

should be drawn from a point 4 feet to 4 feet 6 inches under stage at curtain-line, and from this point an extended line touching the nosing of the first stepping. To this line the nosings of the other steppings should be tangent. (See the sketch section Fig. 3.)

The soffit of the front row of the balcony or gallery should not be less than 12 feet from the stepping, which it immediately overhangs in the circle below, to prevent any discomfort and depression arising from the audience having a ceiling within a short distance of their heads.

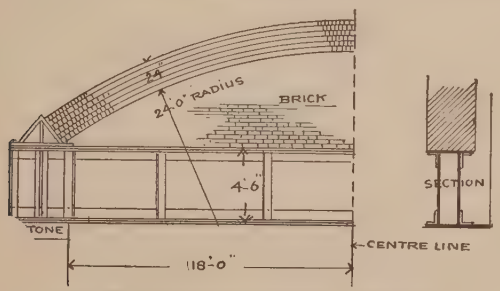
Further, persons placed under a gallery can seldom hear satisfactorily. This defect arises from the comparative smallness of the space in front of the circles through which the sound passes.

By arranging the height of the steppings on the foregoing plan with the nosings tangent to a radial line drawn from a point 4 feet below the stage-floor it is evident that the occupants of the central part of the circles will have a good view of the stage, while those at the extreme sides will have a portion of the stage cut off from their view by the front of the circle-fronts. It is therefore important that the 12 feet under the soffits of the fronts of balcony and gallery be increased rather than diminished. especially when the method is adopted of raking the balcony and gallery toward the sides of the auditorium. The raking fronts to the circles are not to be recommended on artistic grounds, however necessary for practical sighting. The appearance of the interior no doubt suggests a tendency of the raised circles falling toward the stage. When there is little depth to the auditorium, this is particularly noticeable. To overcome this objection there seems to be no practical reason to prevent the first, and in some cases the second, row of seats, together with the circle fronts, being level, and the back rows constructed with an inclination from the centre toward the sides sufficient to obtain the requi-

site line of sight. This reverses the ordinary practice, but would undoubtedly give satisfactory results as regards the sighting, while at the same time retaining a consistent treatment of the architectural and decorative features of the interior.

THE STAGE AND ITS APPURTENANCES.

The necessary mechanical contrivances for working the "slides," "bridges," and "traps" of the stage can only be had from special stage carpenters and machinists, and before the architect can successfully design this portion of the theatre with all its structural requirements the aid of these mechanics is required. Large stages are not advocated, small stages being more desirable for dramatic performances, the audience are better able to see the facial expression of the actors.



CONSTRUCTION OF PROSCENIUM OPENING.

The width of the proscenium opening dominates in a great measure the construction of the stage; in fact it not only determines its height, width, and depth, but the size of the auditorium. A large proscenium opening increases the working expenses; the size of flats, wings, borders, etc., is materially increased. In all the examples of theatres heretofore mentioned and described, proscenium openings 32 to 35 wide are more desirable. In the Empire Theatre the opening is 34 feet wide, Garrick's 34 feet, and Abbey's 35 feet.

CONSTRUCTION OF THE PROSCENIUM OPENING.

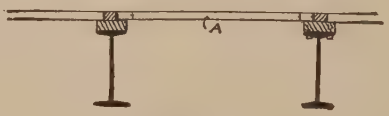
In regard to the construction of the proscenium opening, by referring to the sketch it will be seen that a girder, in addition to a large brick arch, supports the wall over the opening.

The New York Building Law requires this form of construction, and in this case the girder acts more as a tie for the arch that as a girder supporting a direct equally distributed load. A very much smaller girder could be adopted to support the mason-work to the under sides of the arch.

CONSTRUCTION OF STAGE-FLOOR.

The stage-floor is constructed as shown in the following sketch, with a number of narrow openings parallel with the curtain.

These openings are closed at *A* by heavily balanced shutters termed "sliders," which are worked by special mechanism under the stage-floor. These slides can be raised to any



STAGE-FLOOR.

desired height, equal to the height of room under stage, and if the depth is sufficient, as in large opera stages, a mezzanine floor is constructed.

A wide stage is very desirable; it should hardly be less than twice the width of the proscenium opening, and considerably larger if the stairways to fly-galleries and dressing-rooms are placed directly upon the stage.

The depth of the stage from the curtain-line to the back wall is not governed by any arbitrary rules of working, but a well-regulated stage should have its depth equal to or very

little less than the width of proscenium opening. Where actual depth is wanting, the scenic artist will be required to conceal the deficiency by a careful adjustment of the perspectives.

The stage-floor should also project slightly into the auditorium. Three to five feet is a good limit beyond the curtain-line. Sometimes we see stages pitch upward toward the back wall. Although some advantage may be gained by this manner of construction, it is not always desirable nor actually required. The height of stage—i.e., from the floor to the bottom of the "gridiron" or rigging-loft—should be 2 or 3 feet over twice the height of proscenium opening. This allows ample room for any contrivances connected with the fire-curtain to raise it the full height of the opening.

FIRE-CURTAIN.

There are many materials for constructing the fire-curtain, one of which is asbestos, another sheet iron, riveted and joined together.

Probably the best curtain would be that constructed of asbestos and sheet iron, the asbestos being filled between the sheet iron in the following manner: Construct a frame of grooved iron about 1 inch wide and rivet to each side sheets of iron and fill the hollow space with the asbestos.

The curtain is balanced and counterweighted something in the same manner as a window-sash, and works in iron grooves on each side of the proscenium opening.

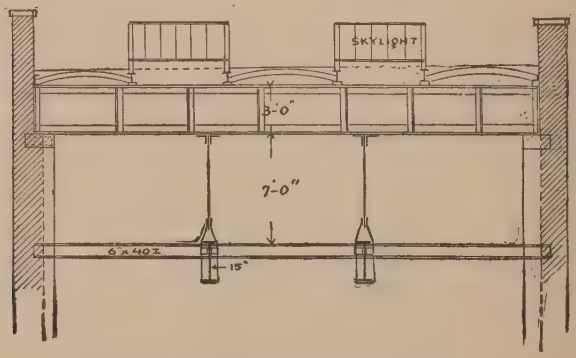
The curtain is generally worked by hand; a better method is that in which the head is secured to the heads of hydraulic rams, fitted into cylinders placed on each side of the proscenium opening and worked by water obtained from a tank on the roof, the waste water being discharged into a tank

in the basement and again pumped into the roof-tank, the water being used over and over again.

This fire-curtain can be controlled from the orchestra as well as from the stage-side.

THE GRIDIRON,

as its name suggests, is a species of naked flooring, and it forms an important and essential feature of the stage. In the Empire and Abbey theatres the gridiron is suspended from the stage roof-girders with large beams running parallel with the proscenium wall and smaller beams framed and secured at right angles to the larger beams; upon these are secured the naked timber flooring or battens, 3 or 4 inches by $1\frac{1}{2}$ to 2 inches thick, and laid about 3 inches apart. In the inter-



SECTION OF GRIDIRON, EMPIRE THEATRE.

spaces are fixed the blocks and wheels through which the ropes run that suspend the "cloths," the ends of the ropes being secured to the cleats attached to the "pin-rails." The battens need only be placed upon the beams over that portion of the stage between the "fly-galleries."

The gridiron should be easy of access and sufficient headway allowed to enable the flymen to adjust their ropes with

facility without being required to be continually stooping; 7 feet is a reasonable height.

The above sketch represents a section through the centre of the stage of the Empire Theatre, showing the position of the gridiron and its relation to the roof. The gridiron is 30 feet wide by 67 feet long, covering the entire stage, and is constructed as shown of two lines of 15-inch beams running parallel the long way of the stage; upon these 15-inch beams the 6-inch beams are placed, 4 feet to 4 feet 6 inches apart, supported and thoroughly secured by knees and bolts, without tie-rods or arches. Upon the 6-inch beams the wooden battens previously mentioned are secured.

This entire framework is suspended by straps and tie-rods from the 3-feet plate-girders of the roof.

The height of the gridiron from the stage is 65 feet, and it is suspended 7 feet below the roof-girders.

The roof of the stage over the gridiron is constructed of 12-inch beams, placed about 6 feet apart, resting upon cast-iron blocks of different heights which make a pitch in the roof, and bolted to the top plates of the girders. The arches that are filled in between the 12-inch beams are constructed with the Guastavino method and covered with asphalt.

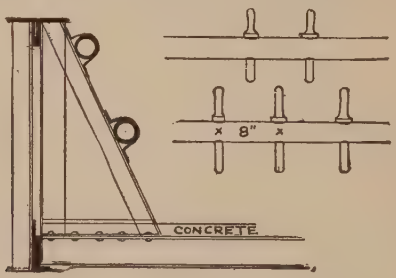
FLY-GALLERIES,

usually called the "flies," are stagings or floors erected on each side of the stage at right angles to the proscenium and extending the entire depth of the stage. The width of the galleries varies according to circumstances; on no account should they extend to within a less distance than 4 feet of the proscenium opening, and if possible should be increased from 6 to 9 feet.

By referring to the plan of balcony of the Empire Theatre, a better conception of these flies can be had. The

gallery upon the right is 8 feet wide, that upon the left 10 feet. The distance of the front of each gallery from the proscenium opening is 7 feet 6 inches. Directly above these fly-galleries another set is constructed and shown upon the gallery plan of the theatre, the right being 6 feet and the left 8 feet wide. These are made narrower to allow the ropes from the pin-rails of first set of flies passing those of the latter set.

The height of the first set of flies from the stage is 28 feet and of the second set 20 feet. These galleries are now constructed entirely fire-proof. The floor is formed of iron or steel beams, one end resting upon brick walls at the side, the



FLY-GALLERY SECTION WITH PIN-RAILS.

other end upon plate- or lattice-girders, and filled in between with terra-cotta arches and covered with a cement floor.

The top of the plate- or lattice-girder is termed the "fly-rail," into which is placed a series of pins—cast iron, wrought iron, or hard wood. The ropes used for slinging the scenery are attached to these pins, and become subject to considerable strain. Very many theatres have a series of wrought-iron pipes connected to these lattice-girders, and the pins let into holes drilled for that purpose through the pipes.

The detail herein shown represents a section of the lower fly-galleries of the Abbey Theatre. The trusses forming the front of these galleries are 5 feet in depth and 42 feet 8 inches long, constructed of two $4'' \times 6'' \times \frac{1}{2}''$ angle-irons for a top

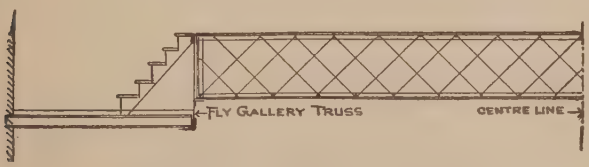
chord, and a $4'' \times 6''$ angle with a $6'' \times \frac{1}{2}''$ plate for the bottom chord, with double $3'' \times 3'' \times \frac{3}{8}''$ angles crossed for latticing, and braces of $4'' \times 4'' \times \frac{1}{2}''$ angles placed about 8 feet or two floor-beams apart, to which they are secured.

The pin-rails are of 6-inch wrought-iron pipe secured to the above braces by wrought-iron straps as shown.

Through the pipe 2-inch holes 8 inches apart are drilled, into which are inserted the pins.

When the first and second tiers of "flies" are not sufficiently roomy, as in very large theatres, three tiers have been found requisite, although for the average comedy theatre two are all that will be required. If more than two are adopted, connect the first and third by lattice bridges, which may be suspended from the roof-trusses, or made sufficiently strong to span the entire distance.

The first set of fly-galleries in the Abbey Theatre are connected as shown in the sketch.



PAINT BRIDGE, ABBEY'S THEATRE.

This paint-bridge is 3 feet high by 50 feet long, and is constructed of two lattice-girders, set 5 feet 6 inches apart, upon which a wooden flooring rests, made in movable sections. The top and bottom chords are made of two angles, $3'' \times 3'' \times \frac{3}{8}''$, and the latticing of $2'' \times \frac{3}{8}''$ flat bars, $16\frac{1}{2}$ inches apart, as shown, riveted to the angle-chords and to each other at every intersection with $\frac{5}{8}$-inch rivets. The two trusses are braced to each other sideways by diaphragms of $2\frac{1}{2}'' \times 2\frac{1}{2}''$ angles crossed.

The above trusses are as economical as could be manufactured, and can be used for any span from 25 up to 50 feet.

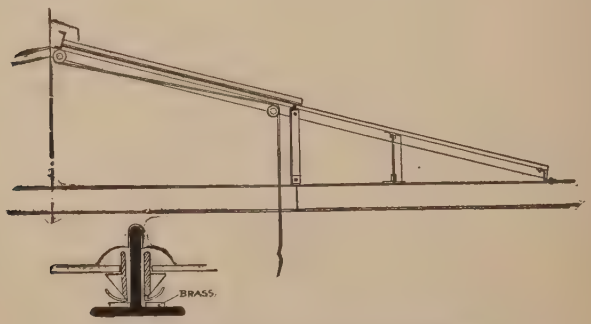
In the Empire Theatre the paint-bridge is constructed of four angles and a web-plate.

In regard to the proper position of these paint-bridges, it is needless to remark that they are generally placed at the back of the stage. Then, again, where it is possible to have passages back of and beyond the stage, they are not needed, and in many cases interfere with the proper working of the scenery.

From the above we infer that the site of the theatre is sufficiently large to admit of a separate large and lofty room for scene-painting.

SLIDING SKYLIGHT OVER STAGE.

The skylight over the stage required by the New York Building Law is constructed similar to that shown by the sketch.



SLIDING SKYLIGHT FOR ROOF OVER STAGE.

A curb of angle- or tee-iron is formed around the openings of an area equal to one-eighth the area of stage-floor, and when the rope is burned or loosened the glass frame resting upon rollers slides down the tee-iron ribs.

APPENDIX.

THE NEW YORK BUILDING LAW RELATING TO THEATRES.

Section 500.

Every theatre or opera house, or other building intended to be used for theatrical or operatic purposes, or for public entertainments of any kind, where stage scenery and apparatus is employed, hereafter erected, shall be built to comply with the requirements of this section.

THE THEATRE TO BE APPROVED BY THE SUPERINTENDENT OF BUILDINGS BEFORE BEING OPENED.—No building which at the time of the passage of this act is not in actual use for theatrical or operatic purposes, and no building hereafter erected not in conformity with the requirements of this section, shall be used for theatrical or operatic purposes, or for public entertainments of any kind, where stage scenery and apparatus are employed, until the same shall have been made to conform to the requirements of this section.

And no building hereinfore described shall be opened to the public for theatrical or operatic purposes, or for public entertainments of any kind, where stage scenery or apparatus is employed, until the superintendent of buildings shall have approved the same in writing as conforming to the requirements of this section; and the mayor of the city of New York shall refuse to issue any license for any such building, and shall close the same, and prevent its opening until a certificate in writing of such approval shall have been given by the superintendent of buildings.

EVERY THEATRE, ETC., TO HAVE ONE STREET FRONT AND SIDE COURTS.—Every such building shall have at least one street front on the street, and in such front there shall be suitable means of entrance and exit for the audience.

In addition to the aforesaid entrances and exits on the street, there shall be reserved, for service in case of an emergency, an open court or space on the side not bordering on the street when said building is located on a corner lot, and on both sides of said building where there is but one frontage on the street.

The width of such open court or courts shall *not be less than seven feet* where the seating capacity is not over one thousand people; above one thousand and not more than eighteen hundred people, eight feet in width; and above eighteen hundred people, ten feet in width. Said open court or courts shall begin on a line with or near the proscenium wall, and shall extend the length of the auditorium proper, to or near the wall separating the same from the entrance-lobby or vestibule.

SEPARATE CORRIDORS TO STREET.—A separate and distinct corridor shall continue to the street, from each open court, through such superstructure as may be built on the street side of the auditorium, with continuous walls of brick or fire-proof materials on each the entire length of said corridor or corridors, and the ceiling and floors shall be fire-proof.

Said corridor or corridors shall not be reduced in width to more than three feet less than the width of the open court or courts, and there shall be no projection in the same; the outer openings to be provided with doors or gates opening toward the street. During the performance the doors or gates in the corridor shall be kept open by proper fastenings; at other times they may be closed and fastened by movable bolts and locks.

The said open courts and corridors shall not be used for storage purposes, or for any purpose whatsoever, except for exit and entrance from and to the auditorium and stage, and must be kept free and clear during performances.

The level of said corridors at the front entrance to the building shall not be greater than one step above the level of the sidewalk where they begin at the street entrance.

The entrance of the main front of the building shall not be on a higher level from the sidewalk than four steps, unless approved by the superintendent of buildings. To overcome any difference of level existing between exits from the parquet into courts and the level of the said corridors, gradients shall be employed of not over one foot in ten feet with no perpendicular rises.

AUDITORIUM EXITS TO SIDE COURTS.—From the auditorium opening into the said open courts, or on the side street, there shall be not less than two exits on each side in each tier, from and including the parquet, and each and every gallery.

Each exit shall be at least five feet in width in the clear, and provided with doors of iron or wood; if of wood, the doors shall be constructed as hereinbefore in this title described. All of said doors shall open outwardly, and must be fastened with movable bolts, the bolts to be kept drawn during performances.

FIRE-ESCAPES, BALCONIES, AND STAIRCASES. — There shall be balconies not less than four feet in width in the said open court or courts at each level or tier above the parquet, on each side of the auditorium, of sufficient length to embrace the two exits; and from said balconies there shall be staircases extending to the ground-level, with a rise of not over eight and one-half inches to a step, and not less than nine inches tread exclusive of the nosing. The staircase from the upper balcony to the next below shall not be less than thirty inches

in width in the clear, and from the first balcony to the ground three feet in width in the clear, where the seating capacity of the auditorium is for one thousand people or less; three feet and six inches in the clear where above one thousand and not more than eighteen hundred people; and four feet in the clear where above eighteen hundred people and not more than twenty-five hundred people; and not over four feet six inches in the clear where above twenty-five hundred people.

METAL AWNINGS OVER OUTSIDE BALCONIES AND STAIRCASES.—All the before-mentioned balconies and staircases shall be constructed of iron throughout, including the floors, and of ample strength to sustain the load to be carried by them; and they shall be covered with a metal hood or awning, to be constructed as shall be directed by the Superintendent of Buildings.

OUTSIDE BALCONIES AND STAIRCASES ON STREET SIDE.—Where one side of the building borders on a street, there shall be balconies and staircases, of like capacity and kind as before mentioned, carried to the ground.

WHEN ON CORNER LOT, A PORTION OF BUILDING MAY BE USED FOR BUSINESS PURPOSES.—When located on a corner lot, that portion of the premises bordering on the side street, and not required for the uses of the theatre, may, if such portion be not more than twenty-five feet in width, be used for offices, stores, or apartments, provided the walls separating this portion from the theatre proper are carried up solidly to and through the roof, and that a fireproof exit is provided for the theatre on each tier, equal to the combined width of exits opening on opposite sides in each tier, communicating with balconies and staircases leading to the street, in manner provided elsewhere in this section; said exit passages shall be entirely cut off by brick walls from said offices, stores, or apartments, and the floors and ceilings in each tier shall be fireproof.

ROOF-GARDEN ABOVE THEATRE.—Nothing herein contained shall prevent a roof-garden, art gallery, or rooms for similar purposes being placed above a theatre or public building, provided the floor of the same, forming the roof over such theatre or building, shall be constructed of iron or steel and fireproof materials, and that said floor shall have no covering boards or sleepers of wood, but be of tile or cement.

Every roof over said garden or rooms shall have all supports and rafters of iron or steel, and be covered with glass or fireproof materials, or both, but no such roof-garden, art gallery, or room for any public purpose shall be placed over or above that portion of any theatre or other building which is used as a stage.

WORKSHOPS, STORAGE- AND PROPERTY-ROOMS.—No workshop, storage- or general property-room shall be allowed above the auditorium or stage, or under the same, or in any of the fly-galleries. All of said rooms or shops may be located in the rear or at the side of the stage, but in such cases they shall be separated from the stage by a brick wall, and the openings leading into said portions shall have fireproof doors on each side of the openings, hung to iron eyes built into the wall.

USE OF THEATRE BUILDINGS FOR OTHER PURPOSES PROHIBITED.—No portion of any building hereafter erected or altered, used, or intended to be used, for theatrical or other purposes as in this section specified shall be occupied or used as a hotel, boarding- or lodging-house, factory, workshop, or manufactory, or for storage purposes, except as may be hereafter specially provided for. Said restrictions relate not only to that portion of the building which contains the auditorium and the stage, but applies also to the entire structure in conjunction herewith.

No store or room contained in the building, or the offices, stores, or apartments adjoining, as aforesaid, shall be let or

used for carrying on any business dealing in articles designated as specially hazardous in the classification of the New York Board of Fire Underwriters, or for manufacturing purposes. No lodging accommodation shall be allowed in any part of the building communicating with the auditorium.

INTERIOR WALLS FIREPROOF.—Interior walls built of fireproof materials shall separate the auditorium from the entrance vestibule, and from any room or rooms over the same; also from any lobbies, corridors, refreshment or other rooms.

ENCLOSURE OF STAIRCASES.—All staircases for the use of the audience shall be enclosed with walls of brick, or of fireproof materials approved by the Superintendent of Buildings, in the stories through which they pass, and the openings to said staircases from each tier shall be the full width of said staircase.

PROSCENIUM WALL AND GIRDER.—A fire-wall, built of brick, shall separate the auditorium from the stage, and the same shall extend at least four feet above the stage-roof, or the auditorium-roof, if the latter be the higher, and shall be coped.

Above the proscenium opening there shall be an iron girder, covered with fireproof materials to protect it from the heat. There shall also be constructed a relieving arch over the girder, the intervening space being filled in with hard-burnt brick of the full thickness of the proscenium wall.

ORCHESTRA PLACED ABOVE THE STAGE.—Should there be constructed an orchestra over the stage above the proscenium opening, the said orchestra shall be placed on the auditorium side of the proscenium fire-wall, and shall be entered only from the auditorium side of said wall.

PROSCENIUM FRAME FIREPROOF.—The moulded frame around the proscenium opening shall be formed entirely of fireproof materials; if metal be used, the metal shall be filled

in solid with non-combustible material and securely anchored to the wall with iron.

CURTAIN FOR PROSCENIUM OPENING TO BE FIREPROOF.—The proscenium opening shall be provided with a fireproof metal curtain, or a curtain of asbestos, or similar fireproof material approved by the Superintendent of Buildings, sliding at each end within iron grooves, securely fastened to the brick wall, and extending into such grooves not less than six inches on each side. Said fireproof curtain shall be raised at the commencement of each performance and lowered at the close of said performance, and be operated by approved machinery for that purpose. The proscenium curtain shall be placed at least three feet distant from the footlights at the nearest point.

IRON DOORS IN PROSCENIUM WALL.—All doorways or openings through the proscenium wall from the auditorium, in every tier, shall have doors of iron or wood on each face of the wall; if of wood, the doors shall be constructed as hereinbefore described, and the doors hung so as to be opened from either side at all times. There shall be no openings in the proscenium fire-wall above the level of the auditorium ceiling. Direct access to these doors shall be provided on both sides, and the same shall always be kept free from any encumbrance.

Iron ladders or stairs, securely fixed to the wall, on the stage side, shall be provided to overcome any difference of level existing between the floor or galleries on the stage side of the fire-wall and those on the auditorium.

SKYLIGHTS OVER STAGE.—There shall be provided over the stage metal skylights, of an area or combined area of *at least one-eighth the area of said stage*, fitted up with sliding sash and glazed with double-thick sheet glass not exceeding one-eighth of an inch thick, and each pane thereof measuring not less than three hundred square inches, and the whole of

which skylight shall be so constructed as to open instantly on the cutting or burning of a hempen cord, which shall be arranged to hold said skylights closed, or some other equally simple approved device for opening them may be provided.

CONSTRUCTION OF STAGE-FLOOR.—All that portion of the stage not comprised in the working of scenery, traps, and other mechanical apparatus for the presentation of a scene, usually equal to the width of the proscenium opening, shall be built of iron or steel beams filled in between with fireproof material, and all girders for the support of said beams shall be of wrought iron or rolled steel.

FLY-GALLERY CONSTRUCTION.—The fly-galleries entire, including pin-rails, shall be constructed of iron or steel, and the floors of said galleries shall be composed of iron or steel beams filled in between with fireproof materials, and no wood boards or sleepers shall be used as covering over beams, but the said floors shall be entirely fireproof.

RIGGING-LOFT OR GRIDIRON.—The rigging-loft shall be fireproof, except the floor covering the same.

STAGE SCENERY.—All stage scenery, curtains, and decorations made of combustible material, and all woodwork on or about the stage, shall be saturated with some non-combustible material, or otherwise rendered safe against fire, to the satisfaction of the superintendent of buildings.

ROOF, FLOORS, AND GALLERIES TO BE FIREPROOF.—The roof over the auditorium and the entire main floor of the auditorium and vestibule, also the entire floor of the second story of the front superstructure over the entrance, lobby, and corridors, and all galleries in the auditorium, shall be constructed of iron or steel and fireproof materials, not excluding the use of wooden floor-boards and necessary sleepers to fasten the same to, *but such sleepers shall not mean timbers of support.*

GALLERY FRONTS.—The fronts of each gallery shall be

formed of fireproof materials, except the capping, which may be of wood.

CEILINGS OF GALLERIES AND AUDITORIUM.—The ceiling under each gallery shall be entirely formed of fireproof materials.

The ceiling of the auditorium shall be formed of fireproof materials.

All lathing wherever used shall be of metal.

PARTITIONS AND FURRING TO BE FIREPROOF.—The partitions in that portion of the building which contains the auditorium, the entrance vestibule, and every room and passage devoted to the use of the audience, shall be constructed of fireproof materials, including the furring of outside or other walls. None of the walls or ceilings shall be covered with wood sheathing, canvas, or any combustible material. But this shall not exclude the use of wood wainscoting to a height not to exceed six feet, which shall be filled in solid between the wainscoting and the wall with fireproof material.

DRESSING-ROOM PARTITIONS.—The walls separating the actors' dressing-rooms from the stage, and the partitions dividing the dressing-rooms, together with the partition of every passageway from the same to the stage, and all other partitions on or about the stage, shall be constructed of fireproof material approved by the superintendent of buildings. All doors in any said partitions shall be of iron, or of wood constructed as hereinbefore described.

All the shelving and cupboards in each and every dressing-room, property-room, or other storage-rooms shall be constructed of metal, slate, or some fireproof material.

DRESSING-ROOMS IN FLY-GALLERIES.—Dressing-rooms may be placed in fly-galleries, provided that proper exits are secured therefrom to the fire-escapes in the open courts, and that the partitions and other matters pertaining to

dressing-rooms shall conform to the requirements herein contained, but the stairs leading to the same shall be fireproof.

AUDITORIUM SEATS.—All seats in the auditorium, excepting those contained in boxes, shall be firmly secured to the floor, and no seat in the auditorium shall have more than six seats intervening between it and an aisle on either side, and no stool or seat shall be placed in any aisle.

PLATFORMS TO RECEIVE SEATS IN GALLERIES.—All platforms in galleries formed to receive the seats shall not be more than twenty-one inches in height of riser nor less than thirty inches in width of platform.

AUDITORIUM AISLES.—All aisles on the respective floors in the audtiorium having seats on both sides of same shall not be less than three feet wide where they begin, and shall be increased in width towards the exits in the ratio of one and one-half inches to five running feet. Aisles having seats on one side only shall be not less than two feet wide at their beginning and increase in width the same as aisles having seats on both sides.

CAPACITY OF FOYERS, CORRIDORS, ETC., GOVERNED BY AUDIENCE.—The aggregate capacity of the foyers, lobbies, corridors, passages, and rooms for the use of the audience, not including aisle-space between seats, shall, on each floor of the gallery, be sufficient to contain the entire number to be accommodated on said floor or gallery, in the ratio of one hundred and fifty superficial feet of floor-room for every one hundred persons.

INCLINED PLANES IN AISLES.—Gradients or inclined planes shall be employed instead of steps where possible to overcome slight difference of level in or between aisles, corridors, and passages.

EXITS—NUMBER PROPORTIONED TO CAPACITY OF HOUSE.—Every theatre accommodating three hundred persons shall have at least two exits; when accommodating

five hundred, at least three exits shall be provided; these exits not referring to or including the exits to the open court or side of the theatre.

WIDTH OF EXIT-DOORS.—Doorways of exit or entrance for the use of the public shall not be less than five feet in width, and for every additional one hundred persons or portions thereof to be accommodated in excess of five hundred an aggregate of twenty inches additional exit width must be allowed.

EXIT-DOORS TO OPEN OUTWARDLY.—All doors of exit or entrance shall open outwardly, and be hung to swing in such a manner as not to become an obstruction in a passage or corridor, and no such doors shall be closed and locked during any representation, or when the building is open to the public.

GALLERY EXITS AND ENTRANCES.—Distinct and separate places of exit and entrance shall be provided for each gallery above the first.

MAIN-FLOOR AND FIRST-GALLERY EXITS.—A common place of exit and entrance may serve for the main floor of the auditorium and the first gallery, provided its capacity be equal to the aggregate capacity of the outlets from the main floor and the said gallery.

WIDTH OF PASSAGE LEADING TO STAIRWAYS. — No passage leading to any stairway communicating with any entrance or exit shall be less than four feet in width in any part thereof.

STAIRWAYS.—All stairs within the building shall be constructed of fireproof material throughout.

Stairways serving for the exit of fifty people must, if straight, be at least four feet wide between railings, or between walls, and if curved or winding five feet wide; and for every additional fifty people to be accommodated six inches must be added to their width.

In no case shall the risers of any stairs exceed seven and a half inches in height, nor shall the treads exclusive of nosing be less than ten and one-half inches wide in straight stairs. In circular or winding stairs the width of the tread at the narrowest end shall not be less than seven inches.

Where the seating capacity is for more than one thousand people, there shall be at least two independent staircases, with direct exterior outlets, provided for each gallery in the auditorium, where there are not more than two galleries, and the same shall be located on opposite sides of said galleries.

Where there are more than two galleries, one or more additional staircases shall be provided, the outlets from which shall communicate directly with the principal exit or other exterior outlets.

All said staircases shall be of width proportioned to the seating capacity as elsewhere herein prescribed. Where the seating capacity is for one thousand people or less, two direct lines of staircases only shall be required, located on opposite sides of the galleries, and in both cases shall extend from the sidewalk-level to the upper gallery, with outlets from each gallery to each of said staircases.

STAGE STAIRWAY.—At least two independent staircases with direct exterior outlets shall also be provided for the service of the stage, and shall be located on the opposite sides of the same.

STAIRWAYS TO UPPER GALLERIES ENCLOSED WITH WALLS.—All inside stairways leading to the upper galleries of the auditorium shall be enclosed on both sides with walls of fireproof materials. Stairs leading to the first or lower gallery may be left open on one side, in which case they shall be constructed as herein provided for similar stairs leading from the entrance-hall to the main floor of the auditorium. But in no case shall stairs leading to any gallery be left open on both sides.

STAIR-LANDINGS.—When straight stairs return directly on themselves, a landing of the full width of both flights, without any steps, shall be provided. Stairs turning at an angle shall have a proper landing without winders introduced at said turn. In stairs when two side flights connected with one main flight no winders shall be introduced, and the width of the main flight shall be at least equal to the aggregate width of the side flights. Circular or winding stairs shall have proper landings introduced at convenient distances.

STAIR HAND-RAILS.—All enclosed staircases shall have on both sides strong hand-rails firmly secured in the wall about *three inches* distant therefrom, and about three feet above the stairs, but said hand-rails shall not run on level platforms and landings where the same is more in length than the width of the stairs.

All staircases six feet and over in width shall be provided with a centre hand-rail of hard wood or metal, not less than two inches in diameter, placed at a height of about three feet above the centre of the treads, and supported on wrought-iron or brass standards of sufficient strength placed not nearer than four feet nor more than six feet apart, and securely bolted to the treads or risers of stairs, or both, and at the head of each flight of stairs, on each landing, the post or standard shall be at least six feet in height, to which the rail shall be secured.

STEAM-BOILERS LOCATED.—Every steam-boiler which may be required for heating or other purposes shall be located outside of the building, and the space allotted to the same shall be enclosed by walls of masonry on all sides, and the ceiling of such space shall be constructed of fireproof materials. All doorways in said walls shall have iron doors.

HEATING.—No floor-registers for heating shall be permitted.

No coil or radiator shall be placed in any aisle or passage-

way used as an exit; but all said coils and radiators shall be placed in recesses formed in the wall or partition to receive the same.

All supply-, return-, or exhaust-pipes shall be properly encased and protected where passing through floors or near woodwork.

STANDPIPES. — Standpipes of two and one-half inches diameter shall be provided with hose attachments on every floor and gallery as follows, namely: One on each side of the auditorium in each tier, also on each side of the stage in each tier, and at least one in the property-room, and one in the carpenter-shop, if the same be contiguous to the building. All such standpipes shall be kept clear from obstruction. Said stand pipes shall be separate and distinct, receiving the supply of water direct from the steam-pumps, and shall be fitted with the regulation couplings of the fire department, and shall be kept constantly filled with water by means of an automatic steam-pump or pumps of sufficient capacity to supply all the lines of hose when operated simultaneously; and said pump or pumps shall be supplied from the street-main and be ready for immediate use at all times during a performance in said building.

AUTOMATIC SPRINKLERS.—A separate and distinct system of automatic sprinklers with fusible plugs approved by the superintendent of buildings, supplied with water from a tank located on the roof over the stage, and not connected in any manner with the standpipes, shall be placed up and around the proscenium opening and on the ceiling or roof over the stage at such intervals as will protect every square foot of stage-surface when sprinklers are in operation. Automatic sprinklers shall also be placed, wherever practicable, under the stage and in the carpenter-shop, paint-rooms, storerooms, and property-rooms.

FIRE-HOSE.—A proper and sufficient quantity of two and

one-half inch hose fitted with the regulation couplings of the fire department, and with nozzles attached thereto, and with hose-spanners at each outlet, shall always be kept attached to each hose attachment.

CASKS OF WATER.—There shall also be kept in readiness for immediate use on the stage at least four casks full of water, and two buckets to each cask. Said casks and buckets shall be painted red.

PORTABLE EXTINGUISHERS.—There shall also be provided hand-pumps or other portable fire-extinguishing apparatus, and at least four axes and two twenty-five-foot hooks, two fifteen-foot hooks, and two ten-foot hooks on each tier or floor of the stage.

LIGHTING.—Every portion of the building devoted to the uses or accommodation of the public, also all outlets leading to the streets, and including the open courts and corridors, shall be well and properly lighted during every performance, and the same shall be lighted until the entire audience has left the premises.

At least two or more oil-lamps on each side of the auditorium in each tier shall be provided on fixed brackets not less than seven feet above the floor. Said lamps shall be filled with whale- or lard-oil, and shall be kept lighted during each performance, or in place of said lamps candles shall be provided.

All gas or electric lights in the halls, corridors, lobby, or any other part of said buildings used by the audience, except the auditorium, must be controlled by a separate shut-off located in the lobby, and controlled only in that particular place.

Gas-mains supplying the building shall have independent connections for the auditorium and the stage, and provision shall be made for shutting off the gas from the outside of the building.

When interior gas-lights are not lighted by electricity, other suitable appliances, to be approved by the superintendent of buildings, shall be provided.

All suspended or bracket lights surrounded by glass in the auditorium or in any part of the building devoted to the public shall be provided with proper wire netting underneath.

No gas or electric light shall be inserted in the walls, woodwork, ceilings, or in any part of the building unless protected by fireproof materials.

All lights in passages and corridors in said buildings, and wherever deemed necessary by the superintendent of buildings, shall be protected with proper wire network.

The footlights, in addition to the wire network, shall be protected with a strong wire guard not less than two feet distant from said footlights, and the trough containing said footlights shall be formed of and surrounded by fireproof materials.

All border-lights shall be constructed according to the best known methods, and subject to the approval of the commissioners of the fire department, and shall be suspended for ten feet by wire rope.

All ducts or shafts used for conducting heated air from the main chandelier, or from any other light or lights, shall be constructed of metal and made double with an air-space between.

All stage-lights shall have strong metal-wire guards or screens, not less than ten inches in diameter, so constructed that any material in contact therewith shall be out of reach of the flames of said stage-lights, and must be soldered to the fixtures in all cases.

The standpipes, gas-pipes, electric wires, hose, footlights, and all apparatus for the extinguishing of fire or guarding against the same, as in the section specified, shall be in charge and under control of the department of buildings, and the superintendent of said department is hereby directed to

see that the arrangements in respect thereto are carried out and enforced.

A diagram or plan of each tier, gallery, or floor, showing distinctly the exits therefrom, shall be printed in a legible manner on the programme of the performance.

Every exit shall have over the same on the inside the word "Exit" painted in legible letters not less than eight inches high.

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